5 March 2008

Mr. Bob Boggs
California Department of Toxic Substances Control
700 Heinz Avenue, Suite 200
Berkeley, CA 94710-2721

Subject: Building 937 Remedial Construction Work Plan, dated March 2008
Presidio of San Francisco, California

Dear Mr. Boggs:

Enclosed please find one hard copy and one electronic copy of the *Building 937 Remedial Construction Work Plan, Presidio of San Francisco, California* dated March 2008 and prepared by Erler & Kalinowski, Inc. (EKI) for the Presidio Trust (Trust). This report presents the construction work plan to remove the floor slab, floor drain, and portions of the subslab sand of Building 937 to mitigate the potential threat to human health posed by the presence of volatile organic compounds (VOCs) in the subslab vapor beneath Building 937. We would like to proceed with this work as soon as possible.

Please contact me at (415) 561-4293 if you have any questions.

Sincerely yours,
The Presidio Trust

Genevieve Coyle

Genevieve Coyle
Environmental Remediation Project Manager

Enclosure

Cc (with enclosure):
Brian Ullensvang, National Park Service (NPS)
Agnes Farres, Regional Water Quality Control Board (RWQCB)
Doug Kern, Restoration Advisory Board (RAB)
Mark Youngkin, RAB (cover letter only)

Erler & Kalinowski, Inc.
Consulting Engineers and Scientists
1870 Ogden Drive
Burlingame, CA 94010
(650) 292-9100
Fax (650) 552-9012

5 March 2008

Ms. Genevieve Coyle
Presidio Trust
34 Graham Street
Post Office Box 29052
San Francisco, California 94129-0052

Subject: Building 937 Remedial Construction Work Plan
Presidio Trust, San Francisco, California
(EKI A70004.21)

Dear Ms. Coyle:

Erler & Kalinowski, Inc. ("EKI") is pleased to present this Remedial Construction Work Plan ("RCWP") for Building 937 located in the Crissy Field Area of the Presidio of San Francisco.

If you have any questions please do not hesitate to call.

Very truly yours,

ERLER & KALINOWSKI, INC.

John T. DeWitt

John T. DeWitt, P.E.
Project Manager

Alexandra Skorik

Alexandra C. Skorik
Project Engineer

REGISTERED PROFESSIONAL ENGINEER
JOHN THOMAS DE WITT
C055468
Exp. 12/31/08
CIVIL
STATE OF CALIFORNIA

Signed 3/5/08

BUILDING 937
REMEDIAL CONSTRUCTION WORK PLAN

PRESIDIO OF SAN FRANCISCO, CALIFORNIA

Prepared for:
The Presidio Trust
San Francisco, California

Prepared by:
Erler & Kalinowski, Inc.
1870 Ogden Drive
Burlingame, California 94010
EKI A70004.21

March 2008

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Remedial Construction Work Plan

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1 INTRODUCTION

On behalf of the Presidio Trust ("Trust"), Erler & Kalinowski, Inc. ("EKI") has prepared this Remedial Construction Work Plan ("RCWP") for Building 937 located in the Crissy Field Area of the Presidio of San Francisco. The RCWP addresses the detected presence of tetrachloroethene ("PCE") and other volatile organic chemicals ("VOCs") in the vapor below the building slab in excess of site-specific commercial/industrial risk-based target concentrations ("RBTCs") (EKI, 2006d). The planned remediation presented in this RCWP is being implemented under the existing Crissy Field Remedial Action Plan ("RAP") (Army, 1998).

2 BACKGROUND

Building 937 is located approximately 450 feet from the San Francisco Bay in the northern portion of the Presidio (key map on Figure 1). The interior building area is approximately 17,600 square feet, and the building sits upon a 6-inch thick concrete slab. Generally, the building overlies fill and the depth to groundwater varies between approximately five and eight feet below ground surface ("bgs"). Building 937 is within Area B of the Presidio but borders Mason Street and Area A to the north and east.

A floor drain is located in the center of the building (Figure 1). The floor drain appears to discharge to the south of Building 937. However, the Trust has not been able to locate a lateral connection point to a sanitary sewer or to the existing 24-inch diameter storm drain that runs in the east-west direction on the south side of Building 937. The 24-inch storm drain is approximately 50 percent blocked and a video camera cannot be inserted into the pipe to identify lateral connections.

2.1 Site Use History

Building 937 was constructed in 1921 and used for aircraft maintenance and later vehicle maintenance (Dames & Moore, 1997b). As noted in the Crissy Field Implementation Report (EKI, 2004), the Army used the Building 923/937 Area (which includes Building 937) for aircraft and vehicle maintenance, auto body work, recharging and draining batteries, solvent storage, transformer storage, painting, waste oil storage, fuel storage, and other activities involving the use of hazardous materials. Historically, the Army operated a 500-gallon waste oil underground storage tank ("UST") and a 1,000-gallon xylenes UST (USTs 937.1 and 937.2) at Building 937. Figure 1 is a map of Building 937. Building 937 is considered part of the historic fabric of the Presidio.

2.2 Previous Environmental Investigations and Remedial Actions

The following is a summary overview of the previous environmental investigations and remedial actions at Building 937.

In 1981, during the installation of a hydraulic lift and associated UST (UST 937.H) situated in the southeastern portion of Building 937, petroleum hydrocarbons were

reportedly observed in soil. Between 1982 and 1984, the Army installed 22 groundwater monitoring wells in the vicinity of Building 937, which identified free product in wells closest to the Building 937 USTs (located on the northern side of the building), with measured thickness ranging between 6 and 36 inches. By 1990, the Army installed 9 additional groundwater monitoring wells in the Building 937 area. In 1992, the Army performed an Interim Remedial Action ("IRA"). This IRA included removal of the tanks and impacted soil as well as the installation of 3 additional groundwater monitoring wells in the Building 937 area. In May 1992, well points were installed upgradient and downgradient of the Building 937 UST area. No free product was observed in the well points.

As part of the IRA, the two USTs were removed along with approximately 500 cubic yards of soil. Part of this excavation was inside Building 937, but was limited to avoid structural damage to the building. Post-excavation verification soil samples were collected and petroleum-related constituents detected in the verification soil samples included total extractable hydrocarbons ("TEH"), total volatile hydrocarbons ("TVH"), xylenes, toluene, ethylbenzene, lead, and other volatile compounds such as acetone and chlorobenzene. Benzene was not detected in the verification soil samples (Watkins-Johnson, 1993).

According to Dames & Moore (Dames & Moore, 1997b), the Army installed an Unterdruck-Verdampfer Brunnen ("UVB") groundwater remediation unit (a vacuum vaporizer well system) at the northeast side of Building 937 during the summer of 1994 as part of the IRA. The objective of the UVB system was to remove VOCs including petroleum hydrocarbons and chlorinated solvents from the groundwater. The UVB system was placed into operation on 28 September 1994, and operated nearly continuously until approximately December 1995, when electrical problems prevented operation. The Army conducted dye studies to evaluate the effectiveness of the system, and added a downhole pump to improve groundwater recirculation in June 1996. The system was operated intermittently with periodic shutdowns due to electrical problems between July 1996 and 22 April 1997 when it was shut down for evaluation and never restarted. The UVB system ultimately was removed in 1998. Dames and Moore concluded that the UVB system could have removed between 4.84 and 17.61 kilograms of VOCs during the first year of operation, which also potentially includes some VOCs from the unsaturated zone (Dames & Moore, 1997b). The Army stated that the UVB system removed some VOCs, but the system operating parameters, especially flow rates and groundwater circulation patterns, did not meet results anticipated in design, likely because the hydraulic conductivity was less than design assumptions. The Army claimed that the UVB system met the need to begin remedial actions (Dames & Moore, 1997b), but the overall effectiveness of VOC removal from the subsurface appeared to be limited.

The combination of the removal of the USTs, soil excavation, and operation of the UVB system appears to have remediated the free product previously detected in the groundwater monitoring wells.

In 1998, the Army prepared the Crissy Field RAP (Army, 1998). To implement the RAP at Building 937, the Army excavated soil from 2 locations on the north side of Building 937: outside the northwest corner of Building 937, and outside the northeast corner, adjacent to and within the footprint of the 1992 excavation. Chemical concentrations in the sidewall verification soil samples from the northwest corner of the building were less than the applicable cleanup levels. The maximum concentrations remaining in place were 4.5 milligrams per kilogram ("mg/kg") total petroleum hydrocarbons as gasoline ("TPHg"), 380 mg/kg total petroleum hydrocarbons as diesel ("TPHd"), 1,000 mg/kg total petroleum hydrocarbons as fuel oil ("TPHfo"), 0.022 mg/kg acetone, and 0.01 mg/kg trichloroethene ("TCE") (International Technology Corporation ("IT"), 1999).

For the second excavation in 1998, the Army excavated approximately 2,605 tons of soil from the northeast corner outside of Building 937. Chemicals detected in the verification soil samples in the excavation wall at the 7.5-foot depth adjacent to Building 937 included TPHg, TPHd, TPHfo, benzene, and toluene. Chemical concentrations were less than the applicable cleanup levels in all verification samples, except for three samples collected adjacent to Building 937, which could not be removed due to the potential for structural damage to the building. The maximum concentrations remaining in place were 7,600 mg/kg TPHg, 7,300 mg/kg TPHd, 21,000 mg/kg TPHfo, 1.5 mg/kg benzene, and 21 mg/kg toluene (IT, 1999). Maximum residual concentrations of selected VOCs from these same locations include 3.4 mg/kg acetone, 1.6 mg/kg methylene chloride, 3.7 mg/kg 1,2-dichlorobenzene, 13 mg/kg ethylbenzene, 21 mg/kg toluene, and 73 mg/kg xylenes. Other chlorinated VOCs, such as PCE and TCE and their breakdown products, were not detected in the confirmation soil samples (IT, 1999). The Army backfilled this excavation with Low Temperature Thermal Desorption ("LTTD")-Treated soil.

Also in 1998, the Army excavated soil from the south side of Building 937 (north of Buildings 933 and 935). Chemical concentrations were less than the applicable cleanup levels in all verification samples. Chlorinated VOCs were not detected in the confirmation soil samples. These excavations were backfilled to original grade (IT, 1999).

In May 2002, the Trust installed 3 soil borings to look for the presence of free-phase hydrocarbons in the smear zone and saturated zone outside the northeast corner of Building 937. TPHg, TPHd, TPHfo, ethylbenzene, and xylenes were detected in soil samples. No free-phase hydrocarbons were observed, and no chlorinated VOCs were detected (Treadwell & Rollo, 2003).

The actively monitored groundwater monitoring well nearest to Building 937 is 937GW108, at the northeast corner of Building 937 (Appendix A, Figure 1). The Trust has been monitoring groundwater at this well since June 2002. Chlorobenzene, benzene, toluene, ethylbenzene, and xylenes have been detected in groundwater samples from this well at concentrations up to 53 micrograms per liter ("µg/L") for chlorobenzene, 61 µg/L for benzene, but below 6 µg/L for the other compounds. In general, other VOCs have not been detected in groundwater samples from this well (Treadwell & Rollo, 2007).

In July 2004, on behalf of the Trust, EKI prepared the Crissy Field Implementation Report (EKI, 2004) to document remedial actions at the Crissy Field sites and to request closure for the sites from the regulatory agencies. In response to the Crissy Field Implementation Report, in August 2005, the Department of Toxic Substances Control ("DTSC") expressed concerns about potential vapor intrusion impacts to indoor air at Building 937 from subsurface chemical releases. In 2005 and 2006, the Trust implemented two field sampling plans to address the concerns raised by DTSC (EKI, 2005 and 2006a). The sampling efforts included subslab vapor, indoor air, soil gas, soil, and groundwater sampling. The results of these investigations (EKI, 2006d) are described in Section 3. Summary tables and Figure 1 from the report are included in Appendix A. These results prompted the need for this RCWP.

The Trust has implemented a land use control ("LUC") for the Building 923/937 Area (which includes Building 937) due to the residual chemicals in the soil, the low-temperature thermal desorption ("LTTD") soil used as backfill, and the potential for indoor air quality issues. A groundwater use restriction also applies at Building 937 (EKI, 2006b and 2006c). This RCWP only addresses residual VOCs in the subslab vapor. The petroleum-related constituents in the soil under the northern wall of Building 937 or in the groundwater are being addressed through the Building 923/937 Area LUC.

2.3 Potentially Exposed Populations

The planned land use at Building 937 is commercial and recreational. The Trust is planning to lease Building 937 to a developer. The Trust's developer plans to renovate Building 937 and convert it into a restaurant and winery. Therefore, RBTC calculations are based on commercial/industrial worker exposure levels, which assume personnel to be on-site for 8 hours per day, five days per week for 25 years. Recreational exposure was evaluated, but was not found to be the driving population in the risk calculations (EKI, 2005). Therefore, the commercial/ industrial scenario was used for identifying RBTCs (EKI, 2006d). In addition, in this report the Trust calculated residential RBTCs so that if the residential RBTCs were achieved, no land use control for indoor air would be required. The process for developing commercial/industrial RBTCs was presented in the 937 Field Sampling Report (EKI, 2006d); similarly, the process for developing residential RBTCs is described in Appendix B of this RCWP.

3 NATURE, EXTENT, AND SOURCE OF CONTAMINANTS

The Trust's 2005/2006 investigation of the potential for vapor intrusion in Building 937 (EKI, 2006d) involved sampling and analysis of subslab vapor, indoor and ambient air, soil gas, soil, and groundwater. The findings of this investigation are summarized in this section. The summary data tables from this investigation are included as Appendix A.

3.1 Extent of VOCs in Subslab Vapor

Subslab soil vapor samples were collected at nine locations in Building 937 on 1 December 2005, and again at the same locations on 20 July 2006 as a means of assessing possible seasonal effects on subslab vapor results. VOCs were detected in the subslab sampling in excess of RBTCs. VOCs detected in subslab vapor samples collected in the Building 937 investigation include benzene, chloroform, PCE, toluene, 1,1,1-trichloroethane ("1,1,1-TCA"), TCE, 1,2,4-trimethylbenzene ("1,2,4-TMB"), 1,3,5-trimethylbenzene ("1,3,5-TMB"), and xylenes. The maximum concentrations of benzene, chloroform, PCE, and TCE exceeded their respective RBTCs for these chemicals with an attenuation factor ("α") of 0.1. Only PCE and TCE were detected in subslab samples at concentrations that exceed their calculated RBTCs with an α of 0.01. PCE was identified as the primary chemical of concern, and was detected at a maximum concentration of 39,900 micrograms per cubic meter ("$\mu g/m^3$"), significantly greater than the RBTCs of 10 $\mu g/m^3$ (assuming α=0.1) and 100 $\mu g/m^3$ (assuming α=0.01)[1] (see Table 2 in Appendix A). PCE and breakdown products from PCE degradation have also been detected in groundwater downgradient of Building 937 (see Section 3.4 below). Vinyl chloride was not detected in any subslab samples.

3.2 Extent of VOCs in Indoor and Ambient Air

Due to the presence of VOCs in excess of RBTCs in the subslab vapor, indoor air samples were collected at four locations within Building 937 and ambient air samples were collected at two locations outside the building. Benzene and PCE were detected in indoor air samples during the Building 937 investigation. Benzene was detected in all air samples at similar concentrations above the benzene RBTC of 0.22 $\mu g/m^3$. The highest benzene concentration in the indoor air was detected in the sample located adjacent to the floor drain. Except for this sample, the benzene in the indoor air was determined to be attributed to benzene in outdoor air. PCE was detected slightly above its RBTC of 1 $\mu g/m^3$ in two indoor air samples. PCE was also detected in one of the ambient air samples at 0.79 $\mu g/m^3$. The risk to the commercial/industrial worker due to PCE in indoor air was calculated to be $1.1X10^{-6}$, a level that does not typically warrant mitigation (EKI, 2006d; DTSC, 2004).

3.3 Extent of VOCs in Soil Gas

Soil gas sampling results from approximately 3.5 to 5 feet bgs indicated that concentrations of PCE, 1,1,1-TCA, and TCE were well below the applicable RBTCs for all depths at all sampling locations, with the exception of sample 937SB112DUP from the northern edge of the building, which exceeded the RBTC for PCE (EKI, 2006d) (see Table 4 and Figure 1 in Appendix A). The concentration of PCE detected in sample 937SB112DUP was 2,850 $\mu g/m^3$, which was collected in a SUMMA canister and analyzed by a fixed laboratory using EPA method TO-15. This concentration exceeds the calculated RBTC for PCE at 3.5 feet bgs of 1,400 $\mu g/m^3$. The PCE concentration in the

[1] The DTSC Vapor Intrusion Guidance (DTSC, 2005) recommends the use of an attenuation factor ("α") from subslab vapor to indoor air of 0.01. For this site, the DTSC requested that an attenuation factor α of 0.1 also be used for screening purposes.

primary sample 937SB112 was 1,100 $\mu g/m^3$, measured in the mobile laboratory by EPA Method 8260B. The other field and lab duplicate sample pair contained essentially the same PCE concentrations of 530 and 494 $\mu g/m^3$, respectively. No VOCs were detected above the RBTCs in soil samples (EKI, 2006d).

Although the concentration of 937SB112DUP was approximately twice the RBTC for PCE at the 3.5 feet bgs depth, the RBTC is based on a 10^{-6} risk for commercial/industrial occupants. This greater concentration, if used, has a resultant cancer risk of $2x10^{-6}$, which is at the low end of the 10^{-4} to 10^{-6} risk management range for CERCLA cleanups and is below Proposition 65 notification requirements.

3.4 Extent of VOCs in Soil

The only VOCs detected in soil samples from Building 937 were acetone and PCE.[2] No value for PCE is listed in the Cleanup Level Document, so PCE concentrations were compared to the Water Board's Environmental Screening Levels ("ESLs") (Water Board, 2005a and 2005b), as recommended in the Cleanup Level Document.[3] The commercial/industrial ESL for PCE based on vapor intrusion to indoor air is 0.24 mg/kg. PCE was only detected in the soil sample and duplicate from boring 937SB112 at concentrations of 0.02 and 0.043 mg/kg, an order of magnitude below the commercial/industrial ESL and below the residential ESL. No other VOCs were detected in the soil samples.

3.5 Extent of VOCs in Groundwater

VOCs detected in groundwater samples at Building 937 included bromodichloromethane, chlorobenzene, chloroform, PCE, and TCE (see Table 5 in Appendix A). Only PCE was detected above the maximum contaminant level ("MCL") of 5 µg/L, at concentrations of 6.3 and 5.9 µg/L from grab groundwater samples 937SB112 and 937SB112DUP. According to the Trust's quarterly groundwater monitoring reports, PCE was last detected in a groundwater sample from monitoring well 937GW108 in June 2002 at a concentration of 3.4 µg/L (Treadwell & Rollo, 2007). Based on the Trust's sampling, VOCs were not found to be a significant issue in site groundwater.

3.6 Site Conceptual Model

Based on the results of the 2005/2006 investigation and review of borehole logs, Building 937 appears to be underlain by 1.5 to 3 feet of sand. Finer grained soils, including silt and sandy silt, are located beneath the sand. Figure 2 presents the Trust's site conceptual model. Although the Trust conducted extensive sampling of soil gas, soil, and groundwater, the source of VOCs in the subsurface was not identified (EKI, 2006d). Given that the VOCs were only found at elevated concentrations in the subslab vapor

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[2] The detected concentration of acetone was 0.068 mg/kg. See Appendix A.

[3] The Trust recognizes that the Cal-EPA, DTSC, and the Water Board prefer indoor air or subslab soil gas data instead of soil screening levels to assess risk from vapor intrusion. The Trust also recognizes the Water Board no longer calculates soil to indoor air environmental screening levels (Water Board, 2007). However, because PCE and TCE were not detected in previous soil samples or were detected slightly above detection limits in soil samples, the PCE and TCE soil screening levels are proposed based in Table E-1b of the 2005 ESLs.

within the sand layer and not in the underlying finer grained soil, soil gas, or groundwater, the source of the VOCs detected in the subslab vapor is likely residual VOCs from a historical release. Discharges to the central floor drain and piping, which may have leaked VOCs to the subsurface of Building 937, could be the primary release mechanism. Stakeholders have discussed the possibility that a historical release may have migrated through the porous subslab sand, but not through the underlying silt layer and may be releasing vapors into the soil gas in the sand layer and subslab vapor.

PCE has been identified as the primary chemical of concern ("COC") in the subsurface due to the frequency of detections, concentrations detected in subslab vapor, and widespread distribution underneath the west-central portion of the building. Other VOCs were more infrequently detected and were detected at lower concentrations than PCE. Detections of other VOCs above the RBTCs also occurred at sample locations where PCE was also detected above RBTCs. Due to the fact that the PCE concentrations were detected above RBTCs only in the vapor below the building slab, the remedial construction should focus on addressing conditions in the subslab sand and vapor.

4 SELECTED REMEDIAL GOALS

This section describes the remedial goals for the remedial construction, as defined by the Crissy Field RAP and the site-specific RBTCs. The Crissy Field RAP soil cleanup levels will be used as minimum cleanup levels for soil during excavation. Environmental screening levels ("ESLs") and RBTCs for soil, indoor air, and/or subslab vapor will also be applied as screening levels, as necessary, to assess vapor intrusion issues. Following the remedial action, indoor air will be tested and site-specific indoor air RBTCs will be applied to assess the effectiveness of the remedy and to ensure that the building is safe for future occupants.

4.1 Crissy Field RAP Soil Cleanup Levels

In 1998, the Army prepared a Final RAP for the Crissy Field Area (Army, 1998) to address the soil and groundwater impacts and associated health risks identified by site investigations. The RAP identifies soil excavation and disposal as the selected remedial alternative for Building 924/937 Area, the area that includes Building 937 (Army, 1998). The Trust's preliminary review of construction alternatives suggested excavation and disposal is appropriate for the Building 937 subslab soil. Therefore, the Crissy Field RAP, and its associated soil cleanup levels, are considered applicable to this RCWP. DTSC representatives have agreed that this RCWP should be conducted within the scope of the existing Crissy Field RAP, rather than generating a separate decision document.

Table 2-4 of the Crissy Field RAP and Table 3-1 of Appendix A of the Crissy Field RAP present human health and ecological soil cleanup levels for Crissy Field. The Crissy Field RAP soil cleanup levels for VOCs are based on a combination of recreational exposure, saltwater ecological organisms, and protection of groundwater quality. The vapor intrusion pathway is not considered in the RAP cleanup levels for VOCs.

The RAP soil cleanup levels are listed in Table 1. For PCE, the RAP presents a soil cleanup level of 15 mg/kg (Table 3-1 in Appendix A of the RAP). The RAP also presents a soil cleanup level of 1.3 mg/kg for TCE (Table 2-4 of the RAP). As this RCWP is being conducted in accordance with the Crissy Field RAP, the RAP PCE and TCE cleanup levels will be used as minimum soil cleanup levels to guide the remediation efforts. However, because the RAP soil cleanup levels do not account for the vapor intrusion pathway, the Trust will use lower RBTC values discussed below in Section 4.2 as target levels in soil during excavation to further reduce the potential for adverse health effects resulting from the possibility of vapor intrusion in the building under the reasonably foreseeable future site use.

4.2 Risk-Based Target Concentrations for Soil, Indoor Air, and Subslab Vapor

The California Environmental Protection Agency, DTSC, and the Water Board have stated a preference for the use of soil gas, subslab vapor, and/or indoor air data rather than soil data for assessing potential vapor intrusion risks from VOCs in the subsurface (California EPA, 2005; DTSC, 2004; Water Board, 2007). For Building 937, the potential risks to future commercial/industrial workers and hypothetical residents were considered to develop site-specific RBTCs.[4] Although Building 937 will have recreational and commercial/industrial land use and associated exposed populations, the Trust has developed RBTCs for a hypothetical resident as screening levels for vapor intrusion into indoor air. The use of the residential RBTCs as screening levels for indoor air would be more conservative than commercial/industrial RBTCs, and would eliminate the potential for a land use control for indoor air at Building 937.

The general approach to develop RBTCs for indoor air and subslab vapor was as follows:

(1) Chemical-specific RBTCs were developed for indoor air ("$RBTC_{IA}$") for each chemical detected in the subslab vapor samples. The RBTCs correspond to a target lifetime incremental cancer risk of 10^{-6} and / or a target Hazard Index of 1.

(2) The $RBTC_{IA}$ was divided by an attenuation factor of 0.1 or 0.01 to calculate the equivalent RBTC for subslab soil vapor ("$RBTC_{SS}$"). The conservative attenuation of 0.1 was used at DTSC's request as part of the screening assessment. However, given that a new building slab will be installed and that Building 937 features 30-foot ceilings and will include a new ventilation system, an attenuation factor of 0.01 is expected to be adequately conservative.

Details of the commercial/industrial RBTC development and calculations are provided in the Building 937 Field Sampling Report (EKI, 2006d); residential RBTC development and calculation are provided in Appendix B of this RCWP. Table 1 lists the residential and commercial/industrial RBTCs for indoor air and subslab vapor.

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[4] A recreational exposure scenario was also evaluated in the *Building 937 Field Sampling Report*, but RBTCs for the commercial and industrial workers were more stringent than the recreational RBTCs.

In order to guide soil remediation, soil screening levels based on vapor intrusion will also be considered. RBTCs were not calculated for VOCs in soil in the Building 937 Field Sampling Report because the detected concentrations were very low and were significantly less than the Water Board's published 2005 Environmental Screening Levels ("ESLs") based on the vapor intrusion pathway. The ultimate effectiveness of the remedy for indoor workers will be assessed based on the indoor air RBTCs. However, to guide the soil excavation activities in the absence of calculated soil RBTCs, the Trust will use the soil ESLs that address the potential for vapor intrusion (from Table E-1b of the 2005 ESL document). The use of ESLs result in PCE and TCE screening levels of 0.087 and 0.26 mg/kg, respectively, for residential land use, and 0.24 and 0.73 mg/kg, respectively, for commercial/industrial land use (Water Board, 2005). Table 1 lists the RAP soil cleanup levels and the ESL-based soil RBTCs for this RCWP. It is noted that in previous sampling at Building 937, no PCE or TCE was found in the soil at levels exceeding the RBTCs (which consider vapor intrusion). Therefore, the implementation of more stringent screening levels during confirmation sampling will likely not have any impact on the extent or amount of soil to be excavated.

5 OVERVIEW OF REMEDIAL ACTION

This section summarizes the planned remedial activities to mitigate the potential threat to human health and the environment posed by the presence of VOCs in the subslab vapor beneath Building 937, taking into account planned development activities and future uses of the property. Section 6 below provides the construction implementation plan for the remedial action.

The planned remedial action, described below, capitalizes on the removal of the concrete slab of Building 937 to access and remove potentially VOC-impacted sand below the existing slab. The Trust's Federal Preservation Officer has identified the original concrete slab to be a character defining element in Building 937. However, a large portion of the original concrete slab in the northeastern corner of the building was previously removed and replaced by the Army during an excavation (Figure 1). As part of the planned building rehabilitation, the developer is required to remove additional portions of the historic slab to accommodate new utility trenches and install structural upgrades to the building. Removal of the concrete slab also allows the Trust to remove the potentially VOC-impacted sand beneath the building slab without causing additional disruption to the building's structure and operation in the future once the tenant occupies the space. The Trust's Federal Preservation Officer has agreed that the benefits of removing the remaining portions of the historic floor to allow soil removal and to accommodate seismic upgrade work justify the removal of the existing concrete slab.

Figure 3 depicts a conceptual schematic of the soil excavation plan. The remedial activities will involve removal of the slab, floor drain, and portions of the subslab sand. The concrete slab will be entirely removed. In areas where previous subslab vapor concentrations were greater than approximately two times the RBTCs, the full depth of the underlying sand will be removed (estimated average depth of 24 inches). The underlying silt will also be examined. If staining is observed, that soil will also be

removed. Subslab sand will not be removed in areas where the previous subslab vapor concentrations were less than two times the RBTCs. Subslab sand (if present) will not be removed in the area in the northeastern corner of the building that was previously excavated by the Army. The concentrations of VOCs in the vapor sample from this area were below reporting limits, and there is no reason to believe VOCs are present within this area that was previously excavated as part of an earlier remedial action.

At the completion of excavation activities, soil samples from the excavation floor will be collected for analysis for VOCs. Figure 4 presents a conceptual layout of confirmation samples. Analytical results will be compared to cleanup levels and RBTCs. Any sample with a concentration exceeding applicable cleanup levels will be over-excavated; samples with concentrations exceeding RBTCs will be evaluated for potential over-excavation. Final confirmation sample results will be provided to stakeholders prior to backfilling operations.

The excavated soil will be stockpiled and subjected to chemical testing. The soil may be reused if chemical concentrations meet residential cleanup level criteria from the Presidio Cleanup Level Document (EKI 2002). If the soil will not be reused, it will be disposed of at a permitted off-site disposal facility in accordance with the results of the chemical testing. The concrete will also be transported off-site for recycling.

Installation of a subslab ventilation ("SSV") system or subslab depressurization ("SSD") system is <u>not</u> part of the remedial action described in this RCWP, though the Trust or developer may choose to install one of these systems prior to backfilling the excavated soil and replacing the floor slab. An SSV or SSD system would provide an additional mechanism to the Trust and developer to address potential vapor intrusion. A conceptual layout for an SSV or SSD system is shown on Figure 5. Appendix C contains design parameters for excavation and optional SSV or SSD systems. If an SSV or SSD system is installed, the operation and monitoring of such a system will not be subject to the Crissy Field RAP, this RCWP, or regulatory oversight.

The DTSC has requested two rounds of post-implementation indoor air monitoring to confirm effectiveness of the soil removal. Results of the monitoring samples will be compared to the RBTCs to evaluate the effectiveness of the remedy.

The total capital cost of the soil excavation (without the optional SSV or SSD piping) has been estimated at approximately $470,000. This estimation takes into account engineering, construction and legal/administration costs, labor costs, soil sample collection and analysis, reporting, and contingencies. No annual operation and maintenance costs are associated with the soil excavation action. Detailed, itemized cost estimate tables are included as Appendix D.

6 IMPLEMENTATION PLAN

6.1 Site Preparation and Security Measures

Prior to initiation of field activities, the developer's contractor will perform the following tasks:

- prepare their site-specific health and safety plan(s);
- obtain and review the results of underground utility surveys;
- notify Underground Services Alert ("USA") of planned subsurface work at least 48 hours prior to the initiation of all subsurface work;
- obtain necessary dig permits and other necessary permits from the Trust.

The slab deconstruction and excavation contractors may also rely upon available plans and utility maps provided by the Trust.

6.2 Health and Safety Plan

The excavation contractor performing soil excavation work at Building 937 will prepare a Health and Safety Plan ("H&SP") and submit it to the DTSC for review. The excavation contractor's H&SP will establish health and safety protocols for contractor personnel in accordance with Federal and California OSHA standards for hazardous waste operations. The H&SP prepared by the excavation contractor will, at a minimum, include the following items:

- Level of personal protection that will be used during excavation activities to protect against injury from physical hazards and VOCs,
- Definition of exclusion, contamination reduction, and support zones; and
- Requirements for personal air monitoring and decontamination procedures.

6.3 Soil Excavation Techniques and Methods

This section describes some of the key activities that will be performed to implement the RCWP. More detailed design parameters are presented in Appendix C. A proposed sampling plan is provided in Appendix E. A plan for perimeter air sampling during the soil excavation is provided in Appendix F.

- **Concrete Slab Removal:** The developer's contractor will saw cut and remove the concrete slab in such a way as to preserve the structure of the building, leaving perimeter and column footings intact or stabilized to support the structure. The removed slab will be transported off-site for recycling or disposal. Standard construction equipment will be used to conduct the slab removal, and ventilation

will be used to protect workers from fumes from internal combustion engines operating inside the building and potential VOC emissions from the subslab.

- **Subslab Sand Removal:** The contractor will excavate sand in the northern and central portion of the building where the highest concentrations of VOCs were detected in the subslab vapor. The sand will be excavated to the top of the underlying silt layer. Any stained soil encountered below the sand layer will also be removed. The conceptual excavation area is shown on Figure 3. EKI anticipates the use of standard excavation equipment. Excavation will be limited to approximately 4 to 5 feet from the building perimeter to maintain the building structural integrity.

- **Overexcavation (if required):** Confirmation soil samples will be collected to ensure that cleanup levels have been met in soil. Soil confirmation data will be compared with soil cleanup levels and RBTCs to assess if further excavation is necessary. If all concentrations in confirmation samples are below cleanup levels and RBTCs and no staining is observed, the excavation activities will be terminated. If a particular confirmation sample has one or more chemical concentrations exceeding cleanup levels or staining is observed, further soil will be excavated in the area where levels remain elevated and the newly excavated area will be resampled. As an extra safeguard, further soil may also be excavated if any chemical concentrations exceed RBTCs. For overexcavated areas, confirmation samples will be collected from overexcavated areas at the same frequency as the confirmation soil samples that were collected from the initial excavation. At a minimum, one sample will be collected from each overexcavation sidewall and bottom. The soil confirmation sampling program, including sample locations and frequencies, is discussed in detail in Appendix E.

- **Subslab Sand Stockpiling and Sampling:** The removed subslab sand will initially be stockpiled onsite, most likely either within Building 937 or the paved parking area directly north of the building. Prior to transportation off-site for reuse or disposal, stockpile samples will be subjected to chemical testing to ensure that the sand meets the chemical standards of the receiving area or disposal facility.

- **SSV or SSD Piping Network (OPTIONAL):** The contractor may install the piping network for potential future SSV or SSD use. A conceptual layout of the SSV or SSD piping is shown on Figure 5.

- **Subslab Monitoring Point Installation (OPTIONAL):** Prior to pouring the replacement concrete slab, the contractor may install subslab monitoring points in various locations below the slab. These points would be connected by copper or steel tubing to a central sample collection station. The conceptual placement of the monitoring points is shown on Figure 5. The actual location of collection tubing and the sample collection station would be coordinated with the developer's architect and structural design team.

- **Backfilling of Excavation:** Following verification that confirmation samples meet cleanup levels, the sample locations will be surveyed and the excavated areas will be backfilled and compacted. If the optional SSV or SSD piping network and monitoring points are installed, the area with the piping network will be backfilled with clean, imported ¾ inch crushed rock or similar material to a uniform depth of 24 inches, and compacted. Backfill material used in the excavation will be fill imported from off-site, fill from another Presidio site, or onsite excavated soils. The potential backfill material will be sampled at each fill source at a frequency and analytical suite consistent with DTSC guidance (DTSC, 2001). To use as backfill within the excavation, the chemical constituent levels in the potential backfill soil shall not exceed the residential cleanup levels identified in the Presidio Cleanup Level Document.

- **Slab Replacement:** After installation of plumbing and subgrade utilities, slab replacement will be performed to meet the developer's requirements.

6.4 Planned Floor Drain Piping Removal

The removal of the slab will also allow removal of the floor drain and associated piping. The Trust filled the drain with grout from within the building to prevent future discharges to the floor drain. However, the Trust has not been able to confirm the direction and connection point for the floor drain piping. Based on discussions with Trust utilities and operations departments, as well as review of available building plans at the NPS Archives, it is believed that the floor drain piping runs in a southerly direction and formerly connected to the storm drain main line south of Building 937. When the Army conducted excavations along the south side of Building 937 in 1998, the lateral from Building 937 was likely disconnected and removed, but no documentation confirming this removal has been found.

The contractor will remove the associated piping to the building perimeter. The floor drain piping may continue beyond the building perimeter, although this scenario is not expected. If the piping extends beyond the building perimeter, the Trust will evaluate the feasibility of continuing to remove the piping beyond the building perimeter to the connection point of a main line, if such a connection exists, as long as the piping is within Area B (e.g., within the Trust's jurisdiction). If the piping extends outside Area B (east of Mason Street), the piping will be removed to the Area A/B line, capped at that point, and the location marked for reference. The DTSC and NPS will be consulted regarding further excavation of the piping within Area A.

6.5 Dust Control

Engineering controls will be implemented to mitigate potential adverse health and environmental effects resulting from dust created by construction and excavation activities. Such controls could include spraying soil with water to prevent particulates from becoming airborne, reducing soil movement rates to limit dust, and reducing drop heights to the minimums needed to complete the work.

6.6 Stormwater Control

Due to the small area of the site (less than ½ acre) and the fact that the entire construction area is situated indoors, stormwater pollution control measures are not anticipated to be applicable to this RWCP. Stormwater controls for stockpiled materials exposed to the elements will include stockpiling on plastic sheeting, covering the stockpile with an anchored cover, and coordinating stormwater drainage around the stockpile.

6.7 Equipment Decontamination

A decontamination area will be necessary to help prevent the spread of contamination from the VOC impacted soil. This decontamination area will be prepared by the contractor implementing the soil removal.

6.8 Waste Disposal

Excavated soil will be stockpiled and characterized prior to being transported for permitted disposal offsite if not reused onsite.

6.9 Sampling and Analysis Plan

The sampling and analysis plan presented in Appendix E will be implemented to verify the achievement of the RAP cleanup levels. This plan outlines procedures for the collection of soil confirmation samples during soil removal activities, soil stockpile samples, and indoor and ambient air samples.

6.9.1 <u>Confirmation Soil Sampling</u>

Confirmation soil samples will be collected from the excavation of the subslab sand and any other areas where soil is removed due to staining. Samples will be collected from the bottom of the excavation and along the sidewalls. Excavation bottom and sidewall confirmation soil samples will be collected on approximately 40 foot centers and 40 linear feet of sidewall, respectively. Figure 4 presents a conceptual layout of confirmation sample locations. Approximately 15 confirmation samples are anticipated. Samples will be analyzed for VOCs by EPA Method 8260 in accordance with the Presidio QAPP. Sample results will be compared with the RAP cleanup levels and RBTCs for soil. If confirmation soil sampling results exceed Crissy Field RAP cleanup levels, such soil will be excavated and additional confirmation samples collected at the same frequency as the confirmation soil samples that were collected from the initial excavation. At a minimum, one sample will be collected from each overexcavation sidewall and bottom. If confirmation soil sampling results exceed RBTCs, the Trust may choose to overexcavate such soil. All confirmation sampling and QA/QC procedures will be in accordance with SOP 001, the Presidio QAPP, and the Crissy Field RAP. A sampling plan is included in Appendix E.

6.9.2 Indoor Air Sampling

Two rounds of indoor air samples will be collected after the building ventilation system is operational and has been balanced. Indoor air samples will be collected and analyzed in accordance with the sampling plan in Appendix E. Indoor air samples will only be analyzed for compounds previously detected in the subslab vapor.

6.10 Perimeter Air Monitoring

Air monitoring will be conducted on the perimeter of Building 937 during construction to confirm that no negative impacts to surrounding populations are occurring. The perimeter air monitoring activities will evaluate both the risk of exposure to VOCs for adjacent worker and recreational users, as well as the adequacy of dust control methods applied by the contractor. Appendix F provides a description of the perimeter air monitoring plan.

6.11 Site Restoration and Protection of Existing Structures

Building 937 is considered a part of the historic fabric of the Presidio. As such, the construction work associated with the construction activities will be planned with the goal of maintaining the original character and exterior appearance of the building. As previously described, the slab will be removed in such a way as to preserve the structure of the building, leaving perimeter and column footings intact or stabilized. Post-construction, an emphasis will be placed on restoring the site to pre-construction conditions.

6.12 Site Closure

The Trust will petition for site closure after VOC concentrations in indoor air samples have been demonstrated to be below RBTCs for two rounds of sampling.

7 SCHEDULE

The Trust anticipates that the developer's construction documents (plans and specifications) will be prepared in parallel with this RCWP. After submitting the final RCWP to the DTSC for review and comment, the Trust will submit the developer's subgrade construction design documents for DTSC review. The contractor's submittals, including its H&S plan, will also be submitted for DTSC review. Excavation in accordance with the RAP will take place after DTSC approvals are received.

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TABLE 1
SUMMARY OF RAP CLEANUP LEVELS AND RBTCs
Building 937, Presidio of San Francisco
San Francisco, California

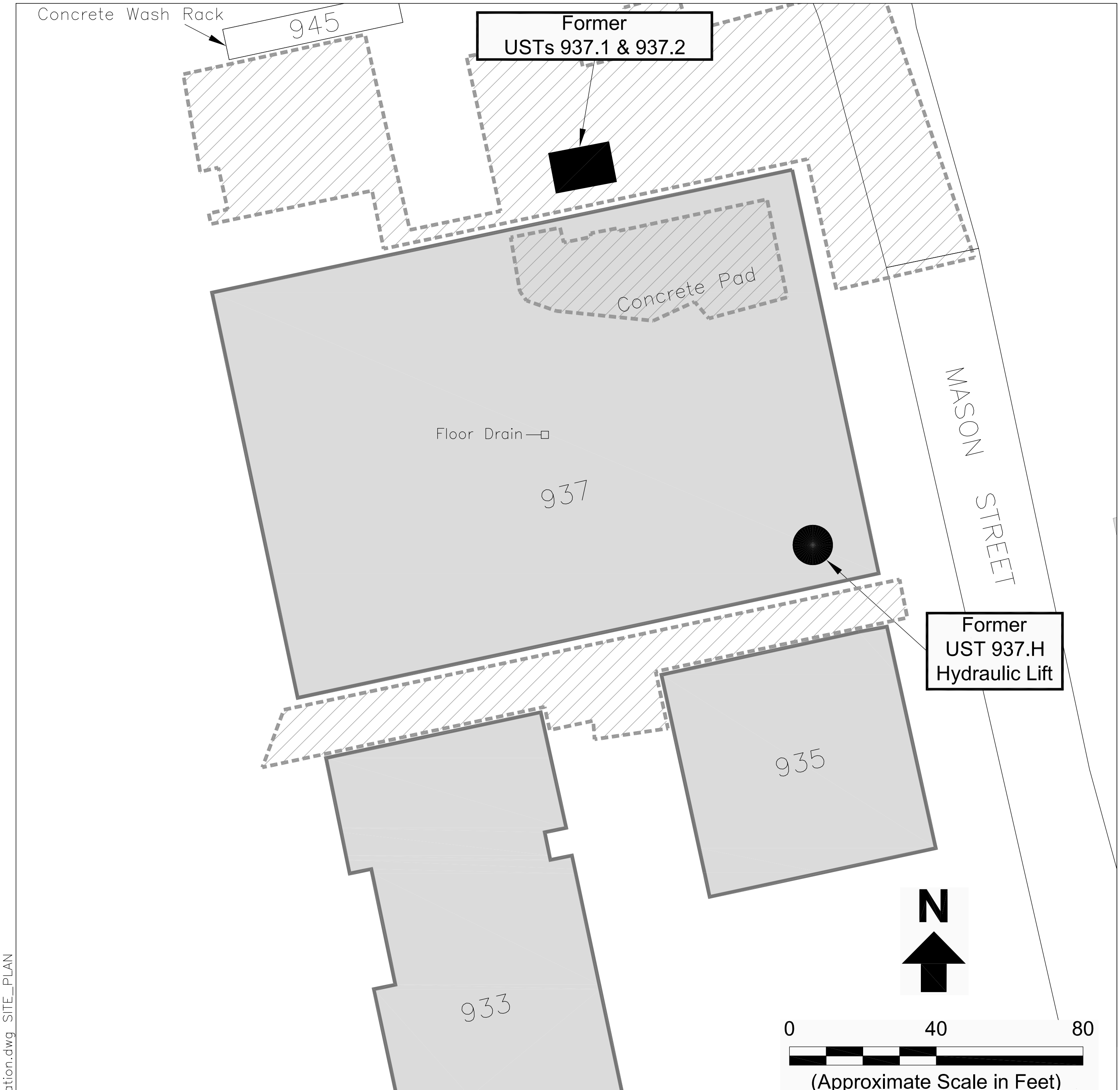
Chemical (a)	RBTCs						RAP Cleanup Levels
	Indoor Air (µg/m3) (b)		Subslab Vapor (µg/m3) (c)		Soil (mg/kg) (d)		Soil (mg/kg) (e)
	Residential Land Use	Commercial/Industrial Land Use	Residential Land Use	Commercial/Industrial Land Use	Residential Land Use	Commercial/Industrial Land Use	Commercial/Industrial Land Use
Benzene	0.07	0.22	7	22	0.18	0.51	1.5
Chloroform	0.38	1.15	38	115	140	330	NA
Tetrachloroethene	0.34	1	34	100	0.087	0.24	15
Toluene	130	630	13,000	63,000	130	310	270
1,1,1-Trichloroethane	450	2,100	45,000	210,000	98	230	NA
Trichloroethene	1	3.1	100	310	0.26	0.73	1.3
1,2,4-Trimethylbenzene	3	12	300	1,200	NA	NA	NA
1,3,5-Trimethylbenzene	3	12	300	1,240	NA	NA	NA
Xylenes, m & p	300	1,500	30,000	150,000	310	420	55
o-Xylene	300	1,500	30,000	150,000	310	420	55

Abbreviations:

ESLs - Environmental Screening Levels (Water Board)
$\mu g/m^3$ - Micrograms per cubic meter
mg/kg - Milligrams per kilogram
NA - Not Available
RAP - Crissy Field Remedial Action Plan
RBTC - Risk-Based Target Concentration

Notes:

(a) RBTCs were only developed for the compounds detected in the Building 937 subslab vapor.
(b) RBTCs for indoor air for Commercial/Industrial land use were calculated in the Buildings 933 and 937 Vapor Intrusion Assessment and Field Sampling Report, 2006.
RBTCs for indoor air for Residential land use were calculated using the exposure parameters in Appendix B.
(c) RBTCs for subslab vapor are based on an attenuation factor of 0.01.
(d) RBTCs for soil are based on ESLs from the Water Board's 2005 ESL document (Table E-1b). No values are available for the compounds marked "NA."
(e) RAP cleanup levels are from Table 2-4 of the Crissy Field RAP and Table 3-1 of Appendix A of the Crissy Field RAP.



Legend:

Former UST Location

Former Army Excavation Areas

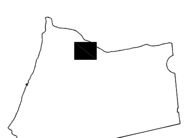
937 Existing Building

Abbreviation:

UST = underground storage tank

Notes:

1. All locations are approximate.
2. Basemap provided by the Presidio Trust.



Erler & Kalinowski, Inc.

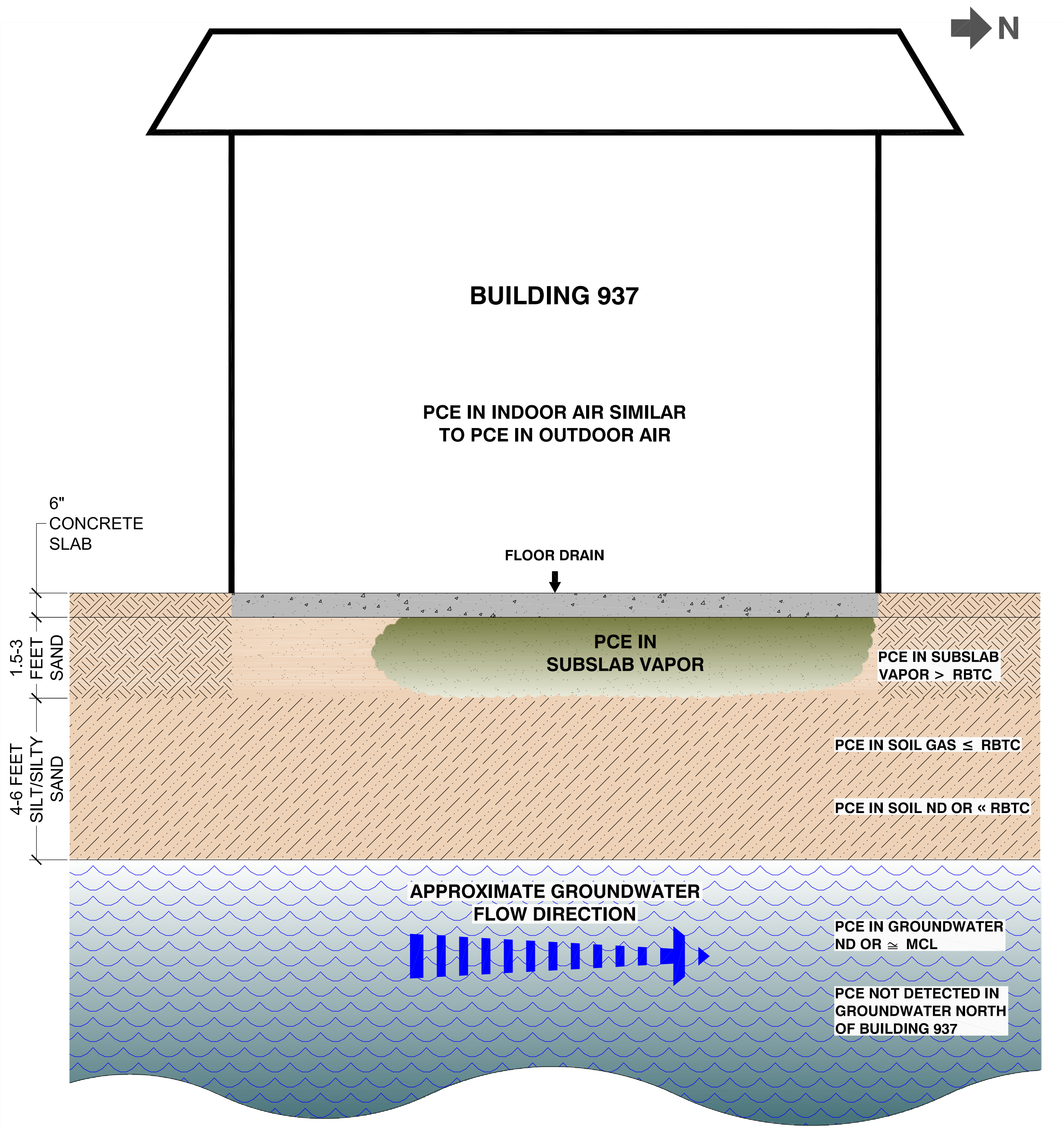
Building 937 Location Map

THE PRESIDIO TRUST

Presidio Trust
San Francisco, CA
March 2008
EKI A70004.21

Figure 1

20080305.11422999 G:\A70004.21\Mar08\Figure 01 - Location.dwg SITE_PLAN



NOT TO SCALE

Abbreviations:

RBTC	=	Risk-based target concentration
ND	=	Not detected above lab reporting limit
PCE	=	Tetrachloroethene
>	=	Greater than
≤	=	Less than or equal to
<<	=	Much less than
≅	=	Approximately equal to
MCL	=	Maximum contaminant level

Notes:

1. All locations are approximate.

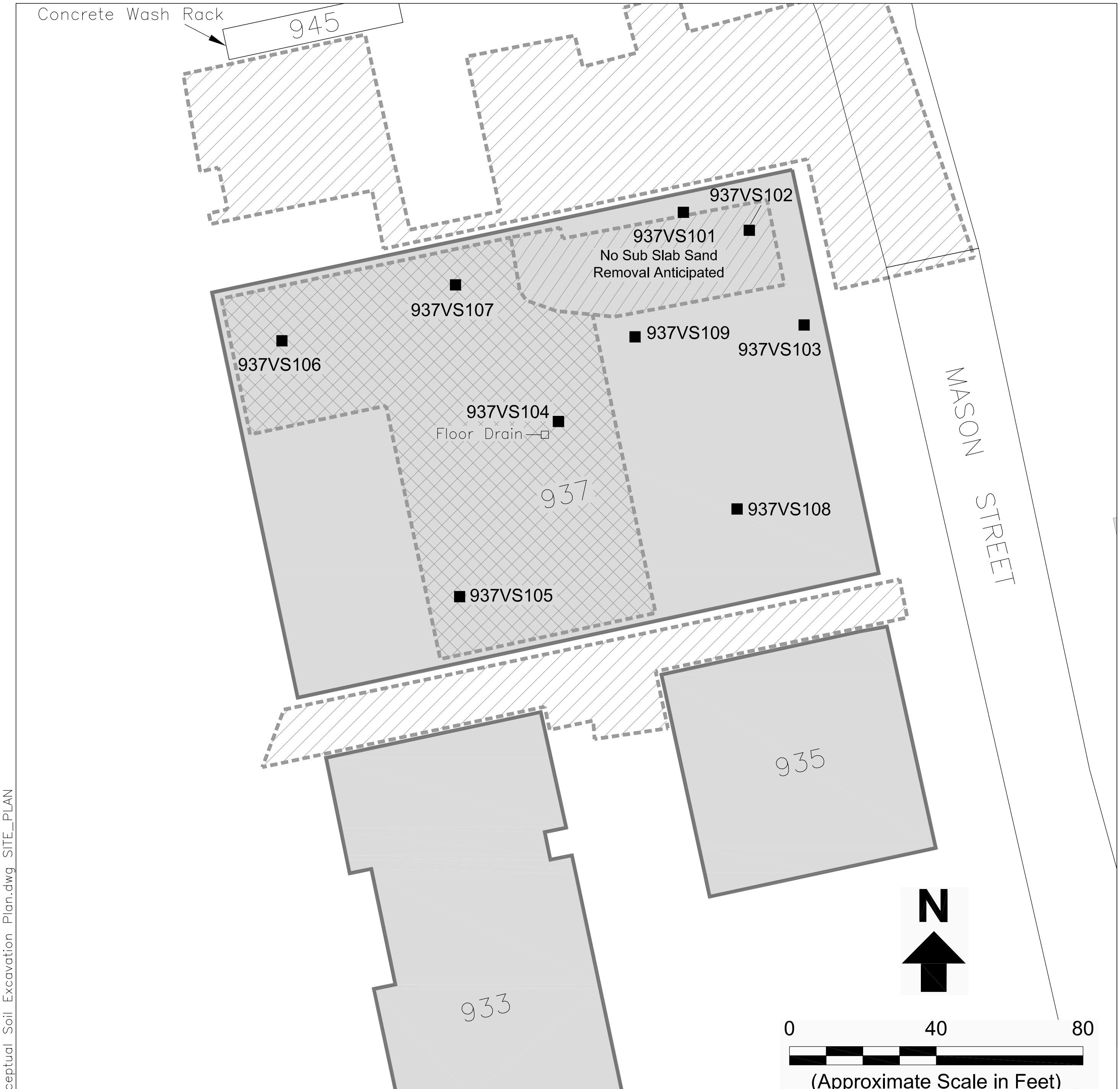
Erler & Kalinowski, Inc.

Conceptual Model of
PCE Distribution at Building 937

Presidio Trust
San Francisco, CA
March 2008
EKI A70004.21

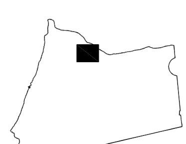
Figure 2

20080305.11473487 G:\A70004.21\Mar08\Figure 02 - Conceptual Model.dwg Layout1



Legend:

- Subslab Vapor Sample Location
- Former Army Excavation Areas
- Area to Remove Sand to Underlying Silt Layer
- 937 Existing Building



Notes:

1. All locations are approximate.
2. Basemap provided by the Presidio Trust.
3. Sample survey locations from PLS Surveys, Inc., 11 July 2006.

Erler & Kalinowski, Inc.

Conceptual Soil Excavation Plan

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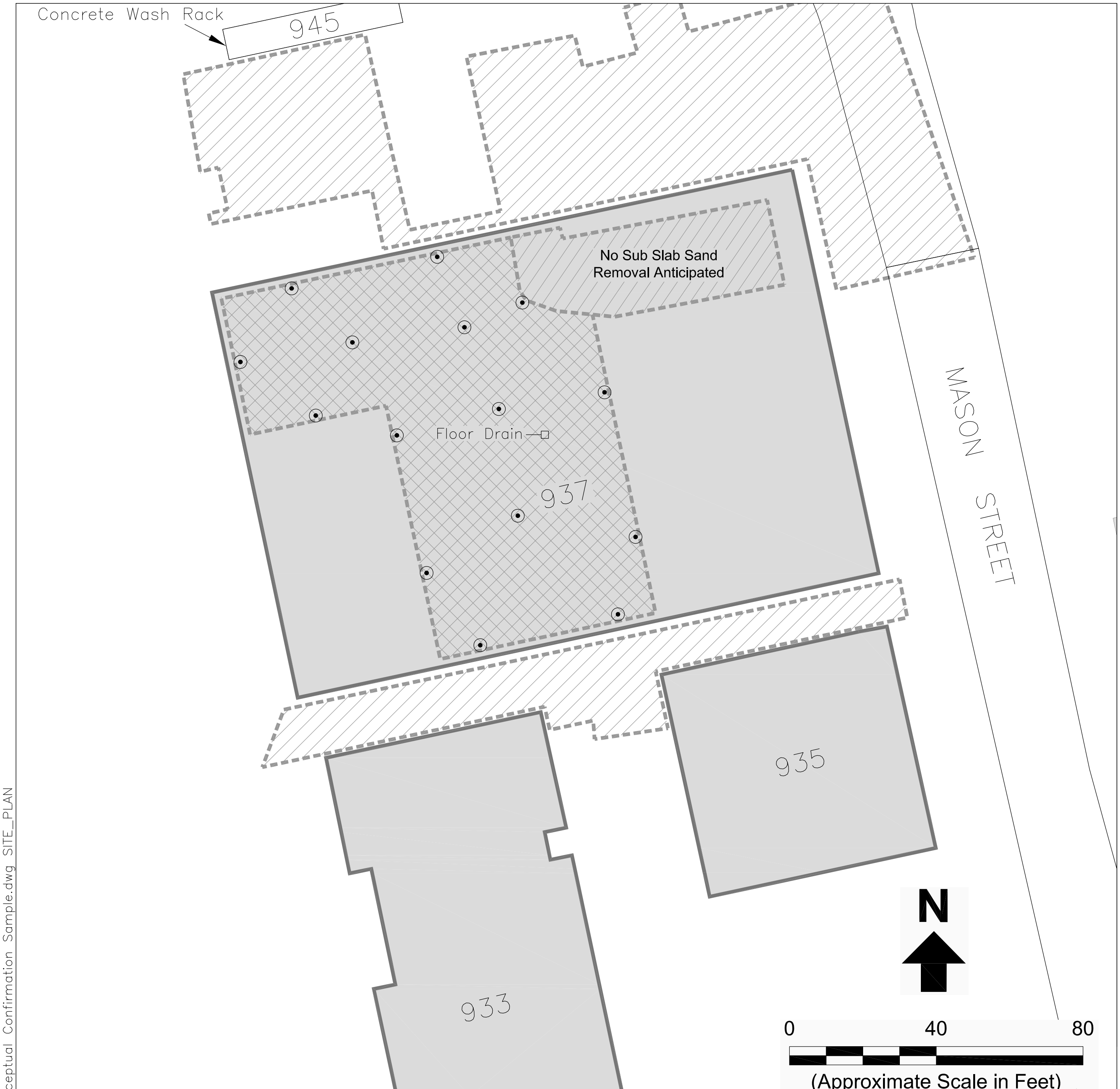
Presidio Trust
San Francisco, CA

March 2008
EKI A70004.21

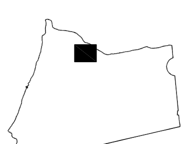
Figure 3

20080305.11483861 G:\A70004.21\Mar08\Figure 03 – Conceptual Soil Excavation Plan.dwg SITE_PLAN



Legend:

- Proposed Confirmation Sample Location
- Former Army Excavation Areas
- Area to Remove Sand to Underlying Silt Layer
- 937 Existing Building



Erler & Kalinowski, Inc.

Conceptual Confirmation Sample Locations

Presidio Trust
San Francisco, CA

March 2008
EKI A70004.21

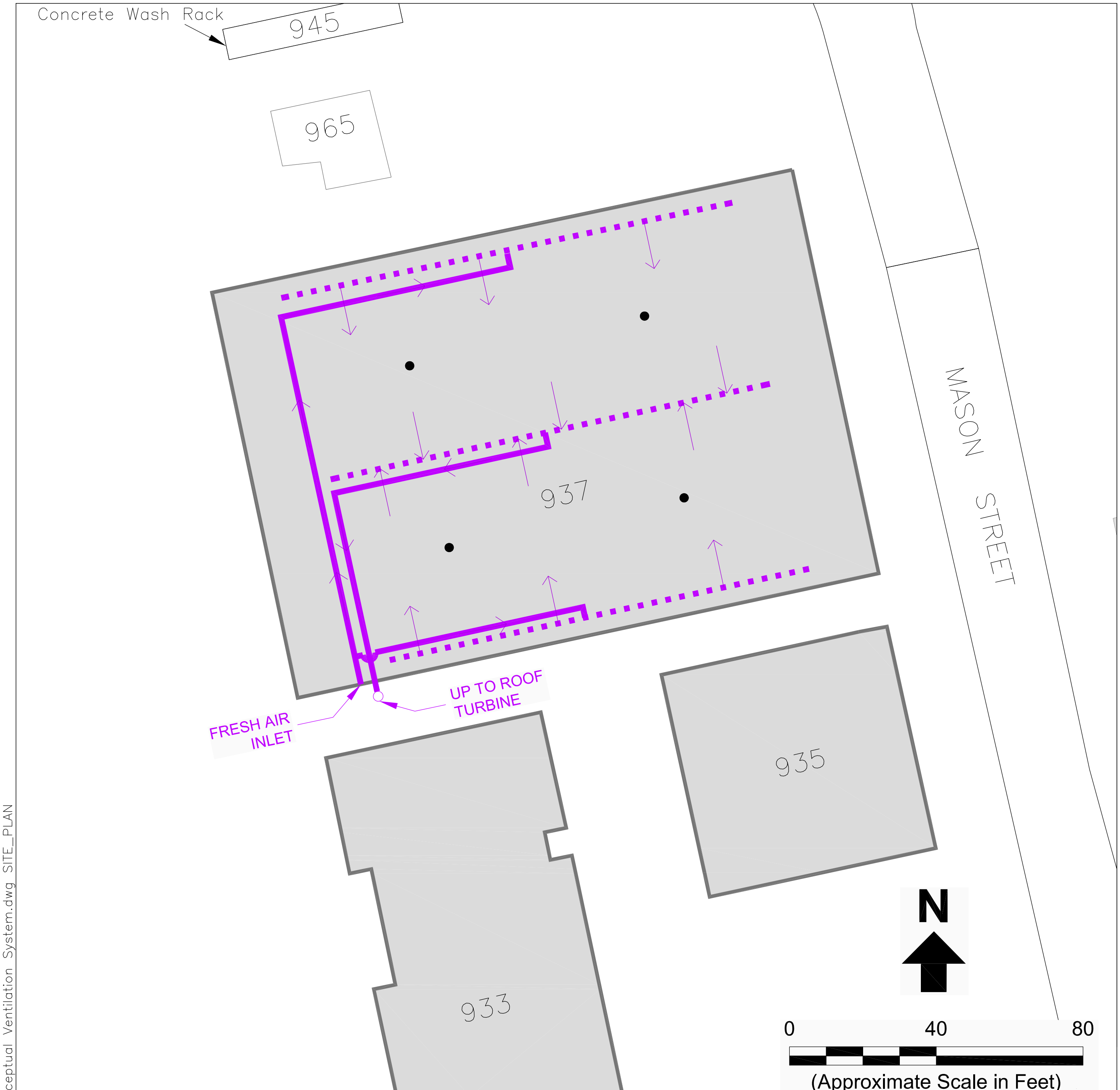
Figure 4

THE PRESIDIO TRUST

Notes:

1. All locations are approximate.
2. Basemap provided by the Presidio Trust.
3. Sample survey locations from PLS Surveys, Inc., 11 July 2006.

20080305.11491009 G:\A70004.21\Mar08\Figure 04 – Conceptual Confirmation Sample.dwg SITE_PLAN



Legend:

937 Existing Building

Subslab Solid Piping

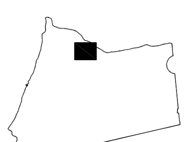
Subslab Perforated Piping

Permanent Monitoring Point

Subslab Air Flow

Notes:

1. All locations are approximate.
2. Basemap provided by the Presidio Trust.



Erler & Kalinowski, Inc.

Conceptual Layout for Optional Subslab Ventilation System

Presidio Trust
San Francisco, CA

March 2008
EKI A70004.21

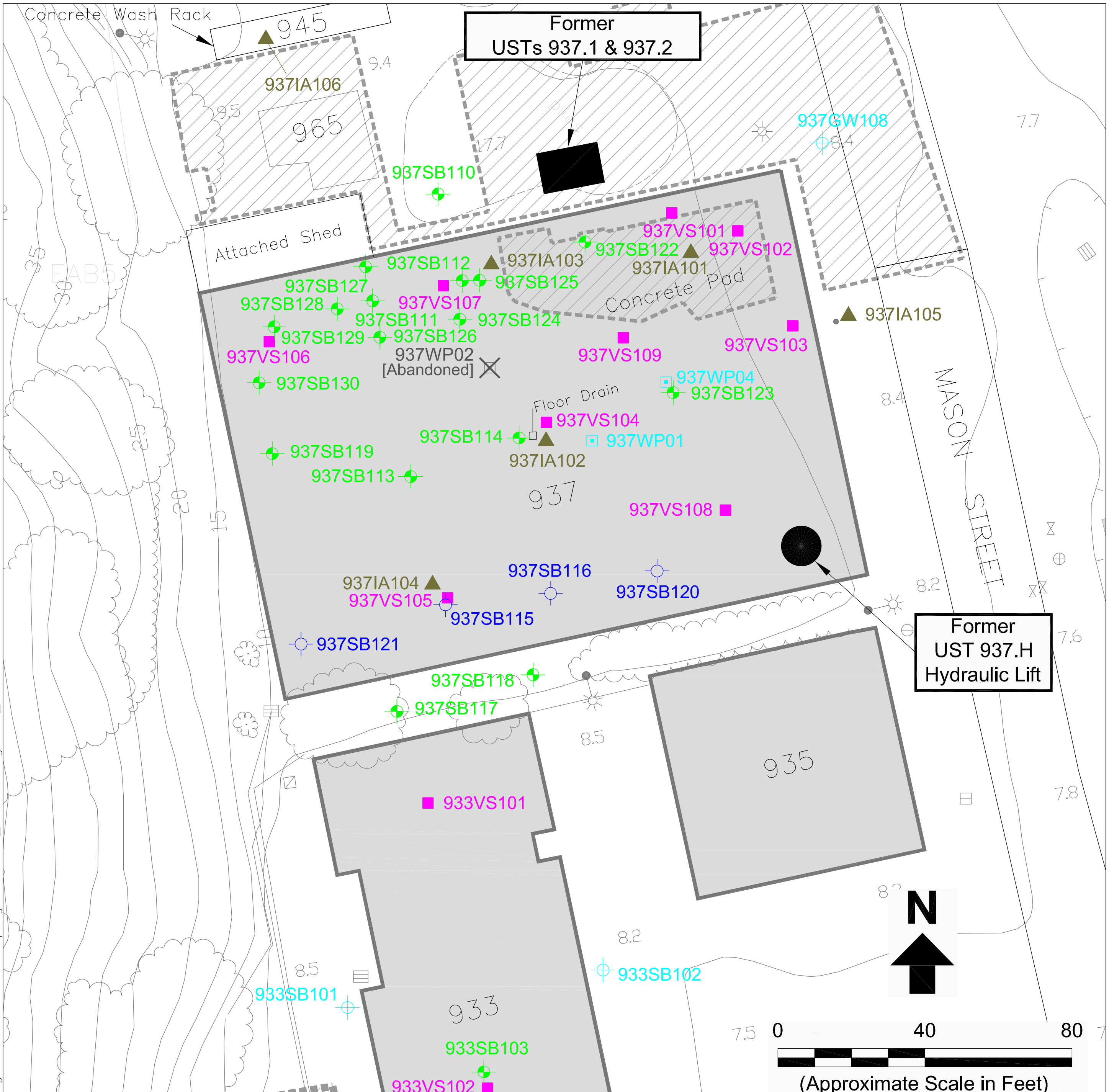
Figure 5

20080305.115411274 G:\A70004.21\Mar08\Figure 05 - Conceptual Ventilation System.dwg SITE_PLAN

APPENDIX A

DATA FROM OCTOBER 2006
FIELD SAMPLING REPORT

Selected Tables and Figure from the *Buildings 933 and 937 Vapor Intrusion Assessment and Field Sampling Report*, dated October 2006

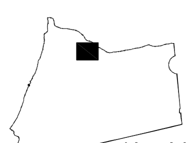


Legend:

- Former UST Location
- Former Army Excavation Areas
- 937 Existing Building
- Air Sample Location
- Well Point
- Grab Groundwater Sample Location
- Subslab Vapor Sample Location
- Soil Gas Sample Location
- Soil Gas, Soil, and/or Grab Groundwater Sample Location

Abbreviations:

UST = underground storage tank



Notes:
1. All locations are approximate.
2. Basemap provided by the Presidio Trust.
3. Sample survey locations from PLS Surveys, Inc., 11 July 2006.

Erler & Kalinowski, Inc.

Buildings 933/937
Sampling Locations

Presidio Trust
San Francisco, CA
October 2006
EKI A000003.08

Figure 1

20061013.0953384 G:\A000003.08\Oct06\Figure 1 - Building 933 and 937 Sampling Locations_colored.dwg SITE_PLAN

TABLE 2
SUMMARY OF SUB-SLAB VAPOR RESULTS FOR VOCS
Buildings 933 and 937, Presidio of San Francisco
San Francisco, California

			Analytical Results (µg/m^3) (a)(b)												
Sample Location	Sample ID	Sample Date	Benzene	Chloromethane	Chloroform	1,1-Dichloroethane	Methylene Chloride	Tetrachloroethene	Toluene	1,1,1-Trichloroethane	Trichloroethene	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Xylenes, m & p	o-Xylene
Building 933															
933VS101	933VS101	6/21/2006	<3.19	2.62	<4.88	4.45	<3.47	**40.6**	<3.77	<5.46	<5.37	<4.92	<4.92	<4.34	<4.34
	933VS101DUP	6/21/2006	<3.19	<2.07	<4.88	<4.05	<3.47	<6.78	<3.77	<5.46	<5.37	<4.92	<4.92	<4.34	<4.34
933VS102	933VS102	6/21/2006	<3.19	<2.07	<4.88	<4.05	7.19	6.99	15.1	<5.46	<5.37	<4.92	<4.92	6.73	<4.34
Building 937															
937VS101	937VS101	12/1/2005	**3.87**	<2.07	<4.88	<4.05	<3.47	**17.2**	<3.77	<5.46	8.38	5.7	<4.92	8.73	<4.34
		7/20/2006	<31.9	<103	<97.7	<202	<174	**113**	<188	<273	<107	<246	<246	<217	<217
937VS102	937VS102	12/1/2005	<3.19	<2.07	<4.88	<4.05	<3.47	<6.78	<3.77	<5.46	<5.37	<4.92	<4.92	<4.34	<4.34
		7/20/2006	1.63	<5.16	<4.88	<10.1	<8.68	<5.09	<9.42	<13.6	<5.37	<12.3	<12.3	<10.9	<10.9
937VS103	937VS103	12/1/2005	<3.19	<2.07	<4.88	<4.05	<3.47	**43.8**	3.81	<5.46	<5.37	<4.92	<4.92	7.6	<4.34
		7/20/2006	**2.68**	<4.13	<3.91	<8.10	<6.95	**62.6**	<7.54	<10.9	<4.3	<9.83	<9.83	13	<8.88
937VS104	937VS104	12/1/2005	<6.39	<4.13	<9.77	<8.1	<6.95	**450**	<7.54	125	<10.7	<9.83	<9.83	<8.68	<8.68
		7/20/2006	<31.9	<103	<97.7	<202	<174	**39,900**	<188	<273	<107	<246	<246	<217	<217
937VS105	937VS105	12/1/2005	**4.5**	<10.3	<9.8	<20.2	<17.4	**5,340**	<18.8	52.3	**1,620**	<24.6	<24.6	<21.7	<21.7
		7/20/2006	<31.9	<20.7	<48.8	<40.5	<34.7	**2,890**	<37.7	<54.6	**1,190**	<49.2	<49.2	<43.4	<43.4
937VS106	937VS106	12/1/2005	<6.39	<4.13	<9.77	<8.1	<6.95	**474**	<7.54	60.9	<10.7	<9.83	<9.83	<8.68	<8.68
		7/20/2006	<31.9	<103	<97.7	<202	<174	**628**	<188	<273	<107	<246	<246	<217	<217
937VS107	937VS107	12/1/2005	<63.9	<41.3	<97.7	<81	<69.5	**5,790**	<75.4	<109	<107	<98.3	<98.3	<86.8	<86.8
		7/20/2006	<6.39	<20.7	<19.5	<40.5	<34.7	**5,750**	<37.7	<54.6	**33.2**	96.2	<49.2	<43.4	<43.4
	937VS107 DUP	12/1/2005	<63.9	<41.3	<97.7	<81	<69.5	**5,970**	<75.4	<109	<107	<98.3	<98.3	<86.8	<86.8
		7/20/2006	<6.39	<20.7	<19.5	<40.5	<34.7	**7,470**	<37.7	<54.6	**43.3**	**175**	66.5	102	47.8
937VS108	937VS108	12/1/2005	<3.19	<2.07	<4.88	<4.05	<3.47	**154**	<3.77	19.9	16.3	9.54	<4.92	6.95	<4.34
		7/20/2006	**3.74**	<5.16	<4.88	<10.1	<8.68	**194**	19.1	26	18.8	24.2	<12.3	37.4	14.8
937VS109	937VS109	12/1/2005	<3.19	<2.07	**12.4**	<4.05	<3.47	**154**	<3.77	<5.46	12	<4.92	<4.92	5.56	<4.34
		7/20/2006	**3.64**	<2.07	**19.9**	<4.05	<3.47	**216**	9.68	<5.46	18.5	8.31	<4.92	15.7	5.08
Sub-slab RBTC α = 0.1 (c)(d)			**2.2**	**1,900**	**11.5**	**38**	**63**	**10**	**6,300**	**21,000**	**31**	**120**	**124**	**15,000**	**15,000**
Sub-slab RBTC α = 0.01 (c)(e)			**22**	**19,000**	**115**	**380**	**630**	**100**	**63,000**	**210,000**	**310**	**1,200**	**1,240**	**150,000**	**150,000**

TABLE 2
SUMMARY OF SUB-SLAB VAPOR RESULTS FOR VOCS
Buildings 933 and 937, Presidio of San Francisco
San Francisco, California

Abbreviations:
α - Sub-slab vapor to indoor air attenuation factor
<0.50 - Compound not detected at or above indicated laboratory reporting limit
µg/m^3 - Micrograms per cubic meter
DTSC - Department of Toxic Substance Control
EPA - Environmental Protection Agency
RBTC - Risk-Based Target Concentration
TIC - Tentatively Identified Compound
VOCs - Volatile Organic Compounds

Notes:
(a) Sub-slab vapor samples were analyzed for VOCs using EPA Method TO-15. Only detected compounds are listed.
(b) The following TICs were detected for subslab vapor samples 937VS101, 937VS108, and 937VS109 collected on 1 December 2005: acetone, 4-methyldecane, n-decane and n-undecane. These TICs are not reported herein.
(c) DTSC vapor intrusion guidance entitled *"Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air"*, dated 7 February 2005, recommends using α = 0.01. However, for this project DTSC has requested the use of α = 0.1 for screening purposes.
(d) Detected concentrations exceeding the site-specific RBTC when α = 0.1 are shown in bold.
(e) Detected concentrations exceeding the site-specific RBTC when α = 0.01 are shown in bold and underlined.

TABLE 3
SUMMARY OF INDOOR AND AMBIENT AIR RESULTS FOR VOCS
Buildings 933 and 937, Presidio of San Francisco
San Francisco, California

Location	Sample Location	Sample ID	Sample Date	Analytical Results (µg/m^3) (a)(b)	
				Benzene	Tetrachloroethene
Building 937					
Indoor	937IA101	937IA101	1/31/2006	**1.26**	<0.68
	937IA102	937IA102	1/31/2006	**2.42**	**1.01**
	937IA103	937IA103	1/31/2006	**1.41**	0.69
		937IA103 DUP	1/31/2006	**1.37**	**1.06**
	937IA104	937IA104	1/31/2006	**1.26**	<0.68
Outdoor	937IA105	937IA105	1/31/2006	**1.39**	0.79
	937IA106	937IA106	1/31/2006	**1.32**	<0.68
RBTC for Air				**0.22**	**1**

Abbreviations:
<0.50 - Compound not detected at or above indicated laboratory reporting limit
EPA - Environmental Protection Agency
RBTC - Risk-Based Target Concentration
µg/m^3 - Micrograms per cubic meter
VOCs - Volatile Organic Compounds

Notes:
(a) Air samples were analyzed for benzene, chloroform, tetrachloroethene, toluene, 1,1,1-trichloroethane, trichloroethene, 1,2,4-trimethylbenzene, xylene (o,-), xylene (m,p-) using EPA Method TO-15. Only detected VOCs are shown.
(b) Air samples that exceed RBTC are shown in bold.

TABLE 4
SUMMARY OF SOIL GAS RESULTS FOR VOCS
Buildings 933 and 937, Presidio of San Francisco
San Francisco, California

Sample Location	Sample ID	Sample Date	Sample Depth (ft bgs)	Analytical Results (µg/m^3) (a)		
				Tetrachloroethene	1,1,1-Trichloroethane	Trichloroethene
Building 933						
933SB103	933SB103	6/14/2006	3.5	<100	<100	<100
Building 937						
937SB110	937SB110	6/14/2006	5	230	<100	<100
937SB111	937SB111	6/14/2006	4	1,400	<100	<100
	937SB111 dup	6/14/2006	4	1,300	<100	<100
937SB112	937SB112	6/14/2006	3.5	1,100	<100	<100
	937SB112DUP (b)	6/14/2006	3.5	**2,850 (c)**	<27.3	<26.9
937SB113	937SB113	6/14/2006	4	360	<100	<100
937SB114	937SB114	6/14/2006	3.5	530	<100	<100
	937SB114 DUP (b)	6/14/2006	3.5	494	64.4	5.7
937SB115	937SB115	6/14/2006	3.5	490	<100	230
937SB116	937SB116	6/14/2006	3.5	130	<100	<100
937SB117	937SB117	6/14/2006	3.5	<100	<100	<100
937SB118	937SB118	6/14/2006	3.5	<100	<100	<100
937SB119	937SB119	6/14/2006	4	600	190	<100
937SB120	937SB120	6/14/2006	4	<100	<100	<100
937SB121	937SB121	6/14/2006	4	<100	<100	160
937SB122	937SB122	6/14/2006	4	160	100	<100
937SB123	937SB123	6/14/2006	4	<100	<100	<100
RBTC at 3.5 ft bgs (d)				**1,400**	**2,700,000**	**3,900**
RBTC at 4 ft bgs (d)				**1,700**	**3,200,000**	**4,600**
RBTC at 4.5 ft bgs (d)				**1,900**	**3,700,000**	**5,300**
RBTC at 5 ft bgs (d)				**2,200**	**4,200,000**	**6,100**
CHHSLS (residential) (e)				**180**	**991,000**	**528**
CHHSLS (commercial) (e)				**603**	**2,790,000**	**1,770**

Abbreviations:
<0.50 - Compound not detected at or above indicated laboratory reporting limit
EPA - Environmental Protection Agency
ft bgs - Feet below ground surface
RBTC - Risk-based Target Concentration
µg/m^3 - Micrograms per cubic meter
VOCs - Volatile Organic Compounds

Notes:
(a) Soil gas samples were analyzed for VOCs using EPA Method 8260B.
(b) Samples 937SB112DUP and 937SB114DUP were analyzed by EPA Method TO-15 in a fixed laboratory.
(c) Soil gas samples that exceed the RBTC for the given depth are shown in bold.
(d) The RBTC for soil vapor (µg/m^3) equals the RBTC for indoor air divided by the compound and site-specific attenuation factor, calculated using the Johnson and Ettinger model. All RBTCs are rounded to two significant figures. The RBTC is a function of depth.
(e) CHHSL = California Human Health Screening Level (California EPA, dated January 2005, Table 1--California Human Health Screening Levels for Soil and Comparison to Other Potential Environmental Concerns).

TABLE 5
SUMMARY OF WATER RESULTS FOR VOCS
Buildings 933 and 937, Presidio of San Francisco
San Francisco, California

Sample Location	Sample ID	Sample Date	Analytical Results (µg/L) Bromodichloromethane	Chlorobenzene	Chloroform	Tetrachloroethene	Trichloroethene
Building 933							
933SB101	933SB101	6/20/2006	0.7	<0.5	<1	<0.5	0.56
933SB102	933SB102	6/20/2006	<0.5	<0.5	<1	<0.5	<0.5
933SB103	933SB103	6/21/2006	<0.5	<0.5	<1	<0.5	<0.5
Building 937							
937SB110	937SB110	6/21/2006	<0.5	<0.5	<1	<0.5	<0.5
937SB111	937SB111	6/20/2006	<0.5	0.92	<1	1.6	<0.5
937SB112	937SB112	6/21/2006	<0.5	<0.5	<1	**6.3**	<0.5
	937SB112 DUP	6/21/2006	<0.5	<0.5	<1	**5.9**	<0.5
937SB113	937SB113	6/20/2006	<0.5	<0.5	<1	2.5	<0.5
937SB114	937SB114	6/20/2006	<0.5	<0.5	<1	0.95	<0.5
937SB115	937SB115	6/20/2006	<0.5	<0.5	<1	0.9	0.63
937SB117	937SB117	6/21/2006	<0.5	<0.5	<1	<0.5	<0.5
937SB118	937SB118	6/21/2006	<0.5	<0.5	<1	<0.5	<0.5
937SB119	937SB119	6/20/2006	<0.5	<0.5	<1	0.92	<0.5
937SB129	937SB129	6/21/2006	<0.5	<0.5	<1	<0.5	<0.5
	937SB129 DUP	6/21/2006	<0.5	<0.5	<1	<0.5	<0.5
937SB130	937SB130	6/21/2006	0.61	<0.5	2.4	<0.5	<0.5
937WP01	937WP01	6/14/2006	<0.5	<0.5	<1	<0.5	<0.5
	937WP01 DUP	6/14/2006	<0.5	<0.5	<1	<0.5	<0.5
937WP04	937WP04	6/14/2006	<0.5	<0.5	<1	<0.5	<0.5
	937WP04 DUP	6/14/2006	<0.5	<0.5	<1	<0.5	<0.5
Presidio Drinking Water Cleanup Levels			**80**	**70**	**80**	**5**	**5**
Crissy Field Rap Cleanup Level (a)			**46**	**21,000**	**--**	**8.25**	**81**
Groundwater RBTCs (b)			**6.8**	**150,000**	**66**	**140**	**330**

Abbreviations:
"--" no value listed in California Toxic Rule
<0.50 - Compound not detected at or above indicated laboratory reporting limit
µg/L - Micrograms per liter
RBTCs - Risk-Based Target Concentrations

Notes
(a) Trichloroethene cleanup level was included in the Crissy Field RAP. The cleanup levels for the remaining chemicals were determined from the California Toxics Rule, (Federal Register Vol. 65, No. 97, 18 May 2000), using the same approach used in the Crissy Field RAP.
(b) Groundwater RBTCs were calculated using Johnson and Ettinger model.

TABLE 6
SUMMARY OF SOIL RESULTS FOR VOCS AND PETROLEUM HYDROCARBONS
Buildings 933 and 937, Presidio of San Francisco
San Francisco, California

				Analytical Results (mg/kg)				
				VOCs (a)			TPH (b)	
Sample Location	Sample ID (c)	Sample Date	Sample Depth (ft bgs) (c)	Acetone (d)	Tetrachloroethene	Other VOCs	TPH Diesel	TPH Gasoline
Building 933								
933SB103	933SB103 [2.5]	6/21/2006	3	0.091	<0.0058	ND	12	<0.46
Building 937								
937SB110	937SB110 [2]	6/21/2006	2.5	<0.068 R	<0.0068	ND	--	--
937SB111	937SB111[2]	6/20/2006	2.5	<0.059 R	<0.0059	ND	--	--
937SB112	937SB112 [2]	6/21/2006	2.5	<0.052 R	0.02	ND	--	--
	937SB112 [2] DUP	6/21/2006	2.5	<0.049 R	0.043	ND	--	--
937SB113	937SB113[2.5]	6/20/2006	3	<0.063 R	<0.0063	ND	--	--
937SB114	937SB114 [1.5]	6/20/2006	2	0.068	<0.0053	ND	--	--
937SB115	937SB115 [2]	6/20/2006	2.5	<0.061 R	<0.0061	ND	--	--
937SB119	937SB119[2]	6/20/2006	2.5	<0.054 R	<0.0054	ND	--	--
937SB124	937SB124[3.5]	6/20/2006	4	<0.058 R	<0.0058	ND	--	--
937SB125	937SB125[2]	6/20/2006	2.5	<0.053 R	<0.0053	ND	--	--
937SB126	937SB126[3]	6/20/2006	3.5	<0.056 R	<0.0056	ND	--	--
937SB127	937SB127[2]	6/20/2006	2.5	<0.065 R	<0.0065	ND	--	--
937SB128	937SB128[3]	6/20/2006	3.5	<0.054 R	<0.0054	ND	--	--
937SB129	937SB129 [2]	6/21/2006	2.5	<0.057 R	<0.0057	ND	--	--
	937SB129 [2] DUP	6/21/2006	2.5	<0.057 R	<0.0057	ND	--	--
937SB130	937SB130 [2]	6/21/2006	2.5	<0.057 R	<0.0057	ND	--	--
Presidio Cleanup Level (e)				**0.24**	**0.24**	**na**	**700**	**610**

Abbreviations:
"--" - not analyzed
ft bgs - Feet below ground surface
mg/kg - Miligrams per kilogram
<0.50 - Compound not detected at or above indicated laboratory reporting limit

na - not applicable
ND - not detected
TPH - Total Petroleum Hydrocarbons
VOCs - Volatile Organic Compounds

TABLE 6
SUMMARY OF SOIL RESULTS FOR VOCS AND PETROLEUM HYDROCARBONS
Buildings 933 and 937, Presidio of San Francisco
San Francisco, California

Notes:

(a) Soil samples were analyzed for VOCs using EPA Method 8260B.
(b) Soil samples were analyzed for TPH using EPA Method 8015.
(c) Sample depths for sample IDs were measured from the bottom of the concrete slab. The total sample depth is as measured from the top of the concrete slab, which is approximately one-half of a foot thick.
(d) Acetone results below laboratory reporting limits are marked with "R" as they were rejected during data validation due to initial and continuing calibration issues. Detected concentrations of acetone were flagged as estimated during data validation.
(e) Presidio Cleanup Levels for recreational land use. TPH values are based on protection of ecological receptors in a terrestrial environment. No value is identified in the Cleanup Level Document for tetrachloroethene. Therefore, the value from the Water Board Environmental Screening Level is used.

APPENDIX B

DEVELOPMENT OF RESIDENTIAL RISK BASED TARGET CONCENTRATIONS

APPENDIX B

DEVELOPMENT OF RESIDENTIAL RISK BASED TARGET CONCENTRATIONS

B.1 DEVELOPMENT OF RISK BASED TARGET CONCENTRATIONS

Risk-Based Target Concentrations ("RBTCs") are site-specific numerical guidelines designed to help with identifying sources of chemicals of concern ("COCs") that may pose significant human health risks, and to determine if mitigation measurements are necessary to reduce potential risks to future building occupants.

In the Trust's Cleanup Level Document (EKI, 2002), Presidio-specific cleanup values were developed for soil, sediment, and groundwater. In the *Building 933 and 937 Vapor Intrusion Assessment and Field Sampling Report* (EKI, 2006) ("2006 Report"), the Trust developed RBTCs for Building 937 due to vapor intrusion assuming recreational and commercial/industrial land use. The Trust is considering residential screening levels for vapor intrusion into indoor air, as a conservative measure, and to avoid a land use restriction for vapor intrusion to indoor air at the site.

The following sections explain the methodology followed to develop residential RBTCs at Building 937 for indoor air, including a list of identified chemicals of concern, exposure pathways and assumptions, toxicity information for the identified COCs, and human health risk equations used to calculate RBTCs.

B.1.1 Identified Chemicals of Concern

All volatile chemicals detected at least once in indoor air, sub-slab vapor, or soil gas samples collected from Building 937 were retained as COCs in soil gas for Building 937. Twelve chemicals were identified as COCs in soil gas: benzene, chloroform, tetrachloroethene ("PCE"), toluene, 1,1,1-trichloroethane, trichloroethene ("TCE"), 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and xylenes. RBTCs for indoor air, sub-slab vapor, and soil gas were developed in the 2006 Report.

B.1.2 Potentially Exposed Populations

U.S. Environmental Protection Agency ("U.S. EPA") defines "exposure" as the contact of a human with a chemical (U.S. EPA, 1989). In order to derive risk-based target concentrations, each group of people that could be potentially exposed to chemicals (*i.e.,* potentially exposed populations) must be defined.

Potentially exposed populations in connection with Building 937 consist of children and adults visiting Building 937 and of commercial/industrial workers. The recreational and commercial/industrial populations were evaluated in the 2006 Report. While the Trust has implemented a land use control prohibiting residential use at Building 937, this appendix evaluates residential exposure scenario for land use control reasons.

The Residential exposure assumes residents may be exposed to volatile organic compounds ("VOCs") 350 days per year for 6 years as a child, and 24 years as an adult.

B.1.3 Potential Exposure Pathways

An "exposure pathway" describes the course a chemical takes from the source to the exposed individual, and generally includes four elements: (1) a source or mechanism of chemical release, (2) a retention or transport medium (*e.g.,* soil, groundwater, soil vapor), (3) a point of human contact, and (4) an exposure route (*e.g.,* ingestion, dermal absorption, inhalation (U.S. EPA, 1989). An exposure pathway is described as "complete" when all of these elements are met for an individual receptor.

Vapor intrusion into indoor air is the only potentially complete exposure pathway at Building 937,[1] and is described below.

Vapor intrusion begins when VOCs partition into soil gas in the subsurface. The magnitude to which these compounds partition or volatilize into soil gas depends on the properties of the chemical. VOCs with higher vapor pressures, lower water solubilities, and lower affinities for sorption to soil, partition into soil gas to a greater extent than chemicals that do not have these properties.

Once in soil gas, some of the VOCs may migrate upwards or laterally by both diffusion and advection. Diffusion refers to the migration of chemicals from areas of high chemical concentration to areas of low chemical concentration. Diffusion is a relatively slow transport process as compared to advection, which occurs when soil gas containing volatile compounds is induced to migrate by pressure gradients. Soil gas containing VOCs may migrate into a building by diffusing through cracks in the foundation slab. Lower pressure inside a building may also sweep soil gas into the building through cracks or gaps by advection. The phenomenon of a lower pressure inside a building is sometimes referred to as a "stack effect." A stack effect can be caused by:

- Warmer air inside the building, which tends to rise and draw air from the lower parts of the building.
- Wind, which tends to impart a lower pressure inside the building.
- Manufacturing equipment exhausts, which tend to draw air into the building and lower the interior pressure.
- Mechanical ventilation systems, which induce a slight negative pressure inside the building.

[1] Due to residual chemical concentrations under the building foundation at the northeastern corner of Building 937, the land use control for the site requires that the site be capped and appropriate health and safety measures to be taken if the cap is breeched for maintenance or other construction activities.

In addition, tidal pumping (e.g., a rising tide) could cause a diurnal increase in vapor intrusion.

B.1.4 Toxicity Assessment

As defined by the U.S. EPA, the purpose of the toxicity assessment is to weigh available evidence regarding the potential for particular contaminants to cause adverse effects in exposed individuals and to provide, where possible, an estimate of the relationship between the extent of exposure to a contaminant and the increased likelihood and/or severity of adverse effects (U.S. EPA, 1989). The two broad categories of adverse human health effects recognized in the assessment of health risks are non-carcinogenic and carcinogenic effects.

California Environmental Protection Agency ("Cal-EPA"), particularly the Office of Environmental Health Hazard Assessment ("OEHHA"), and U.S. EPA are the primary sources of published toxicity estimates for various chemicals used in assessment of risks at contaminated sites. Toxicity criteria developed by both Cal-EPA and U.S. EPA are generally derived only for two exposure routes, ingestion (oral) and inhalation, by which the chemical enters the body.

This section provides quantitative estimates of the toxic effects associated with chemical of concern at Building 937, based on non-carcinogenic and carcinogenic effects, as described below. The sources from which toxicity data were obtained are discussed in Section B.1.4.3.

B.1.4.1 Non-Carcinogens Target Risk Level

As defined by U.S. EPA (U.S. EPA, 1989), non-carcinogenic effects are organ-specific and are manifested only after reaching a certain chemical dose. As a result, a range of exposures exists from zero to some finite value that can be tolerated with essentially no chance of adverse effects. The upper bound on this tolerance range or "safe dose" is identified as a reference dose ("R*f*D"), which represents the estimated maximum daily intake per unit body weight that can be tolerated without adverse health effects. Units of the RfD are dosage units, milligrams of chemical intake, per kilogram of body weight, per day *(i.e.,* mg/kg-day). A low RfD indicates a low threshold dose level and, therefore, a high chemical toxicity. Conversely, a chemical with a higher RfD has lower non-carcinogenic toxicity.

U.S. EPA (U.S. EPA, 1989) estimates the potential for non-carcinogenic effects by comparing a chronic exposure level (i.e., greater than 7 years) over a specified time period with a reference dose derived for a similar exposure period. This ratio of exposure to toxicity is called the hazard index ("HI"). Consistent with the NCP at 40 CFR 300.430(e)(2)(i)(A)(1), U.S. EPA (1991) established the standard default non-carcinogenic target risk level to correspond to a HI of unity (i.e., 1). This target risk level is equivalent to the degree of chemical exposure from all significant exposure pathways in a given medium below which it is unlikely for even sensitive populations to

experience adverse health effects. A target HI of 1 was used to derive RBTCs at Building 937, based upon non-carcinogenic effects.

B.1.4.2 Carcinogen Target Risk Level

Carcinogenesis, unlike non-carcinogenic effects, is generally thought to be a phenomenon for which risk evaluation based on presumption of a threshold is inappropriate (U.S. EPA, 1989). For carcinogens, U.S. EPA assumes that a small number of molecular events can evoke changes in a single cell that can lead to uncontrolled cellular proliferation and eventually to a clinical state of disease. This hypothesized mechanism for carcinogenesis is referred to as "non-threshold" because there is not believed to be a level of exposure to such a chemical that does not pose a finite probability, however small, of generating a carcinogenic response. No dose is thought to be risk-free. Therefore, in evaluating cancer risks, a safe dose cannot be estimated.

For carcinogenic effects, U.S. EPA uses a two-part evaluation. In the first part of this evaluation, the chemical is assigned a weight-of-evidence classification, which is related to how convincingly the scientific studies demonstrate that the chemical is carcinogenic to humans. In the second part of this evaluation, a cancer slope factor ("CSF") is calculated, which is a measure of the chemical's potency. U.S. EPA (U.S. EPA, 1989) estimates risks as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen. This probability is defined as the incremental or excess lifetime cancer risk. The CSF is the 95 percent upper confidence limit on the slope of the low-dose linear portion of the dose-response curve as estimated by the multistage linear model.

The CSF directly relates the incremental risk of cancer over a lifetime (i.e., 70 years) to the degree of chemical exposure averaged over a lifetime. U.S. EPA (1991) established the standard default carcinogenic target risk level to correspond to a one-in-one million (i.e., 10^{-6}) incremental risk of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen from all significant exposure pathways for a given medium. Federal Regulations (40 CFR §300.430(e)(2)(i)(A)) provide a definition of an acceptable residual cancer risk range of 10^{-4} through 10^{-6} for the selection of remedial actions that protect human health and the environment. U.S. EPA has stated that remediation is generally not warranted for contaminated property if the cumulative cancer risk is less than 10^{-4} (1991). If remediation is undertaken at such a property, U.S. EPA has expressed a preference for cleanups that achieve the more protective end of this target risk range (1991). However, U.S. EPA acknowledges that remedial actions that achieve reductions in site risk anywhere within the 10^{-4} through 10^{-6} risk range may be acceptable after considering site-specific conditions (1991). The State of California has adopted 10^{-5} as the "no significant risk" level for protecting persons from exposure to chemicals in consumer products and commercial establishments under *The Safe Drinking Water and Toxic Enforcement Act*, which is commonly referred to as Proposition 65. At the Presidio, the target risk level for individual chemicals has been established at a lifetime incremental cancer risk of 10^{-6} (EKI, 2000).

B.1.4.3 Sources of Toxicity Information

Carcinogenic slope factors and non-carcinogenic reference doses are obtained from the following hierarchy of regulatory sources as described in the Cleanup Level Document (EKI, 2002), which is generally consistent with California Human Health Screening Levels ("CHHSLs"):

- Cal/EPA OEHHA Toxicity Criteria Database, dated 10 August 2005.
- U.S. EPA's computerized Integrated Risk Information System ("IRIS").
- U.S. EPA's Health Effects Assessment Summary Tables ("HEAST"), dated July, 1997.
- U.S. EPA's National Center for Environmental Assessment ("NCEA"), Draft Risk Assessment Issue Papers for individual chemicals.
- U.S. EPA Region IX Preliminary Remediation Goals ("PRG") Tables, October 2004.

Non-carcinogenic reference doses and carcinogenic slope factors for chemicals of concern at Building 937 are presented in Tables B-1 and B-2, respectively.

B.1.5 Exposure and Physical Parameters

Table B-3 summarizes exposure assumptions for the potentially exposed populations at Building 937. Exposure parameters are default values obtained from DTSC or U.S. EPA guidance documents, except for the exposure frequency and exposure time for recreational users, and the event duration for the teenage recreational user. Professional judgment was used to estimate these parameters because default values do not exist for these factors for recreational users. In addition, the averaging time is 75 years for carcinogenic effects, and is set equal to the exposure duration for non-carcinogenic effects, in accordance with the *Exposure Factors Handbook Volume I General Factors: Principles and Application* (US EPA, 1997).

B.2 CALCULATION OF RISK-BASED TARGET CONCENTRATIONS

The equations used to calculate residential RBTCs in indoor air and sub-slab vapor are presented in the following sections.

RBTCs for indoor air and subslab vapor are presented in Table B-4. The minimum RBTCs for indoor air and sub-slab soil vapor are included in the summary Table 1 in the main document.

B.2.1 Development of Risk-Based Target Concentrations for Indoor Air

For each volatile chemical of concern, chemical-specific risk-based target concentrations for indoor air for cancer risks ("$RBTC_{IA\text{-}c}$") in units of $\mu g/m^3$ are calculated according to the following equations:

$$RBTC_{IA\text{-}c} = \frac{\text{Target Risk Level of } 10^{-6}}{CSF_i \times CF \times (\text{Inhalation}_{child} + \text{Inhalation}_{adult})}$$

where:

CF	Conversion Factor of 10^{-3} mg/ug
CSF_i	Inhalation Cancer Slope Factor $(mg/kg\text{-}d)^{-1}$ (chemical-specific, see Table B-2)
$RBTC_{IA\text{-}c}$	Risk-Based Target Concentration for Indoor Air for Carcinogenic COCs (ug/m^3)

The inhalation exposure to COCs for children and adult populations at Building 937 are estimated with the following equation:

$$\text{Inhalation} = \frac{IR \times ET \times EF \times ED}{BW \times AT}$$

where:

AT	Averaging Time (days) (population-specific, see Table B-3)
BW	Body Weight (kg) (population-specific, see Table B-3)
ED	Exposure Duration (years) (population-specific, see Table B-3)
EF	Exposure Frequency (days/year) (population-specific, see Table B-3)
ET	Exposure Time (hr/day) (population-specific, see Table B-3)
IR	Air Inhalation Rate (m^3/hr or m^3/day) (population-specific, see Table B-3)

Exposure assumptions for the potentially exposed populations evaluated at Building 937 are presented in Table B-3. The appropriate values should be substituted into the equations to calculate $RBTC_{IA\text{-}c}$ values for the residential exposure scenario.

For non-carcinogenic COCs, risk-based target concentrations for indoor air ("$RBTC_{IA\text{-}nc}$") are calculated with the following equation:

$$RBTC_{IA\text{-}nc} = \frac{R\mathit{f}D_i \times \text{Target HI of } 1}{CF \times (\text{Inhalation}_{child})}$$

where:

CF	Conversion Factor of 10^{-3} mg/µg
$RBTC_{IA\text{-}nc}$	Risk-Based Target Concentration for Indoor Air for Non-Carcinogenic COCs ($\mu g/m^3$)
RfD_i	Inhalation Reference Dose (mg/kg-d) (chemical-specific, see Table B-1)

As above for carcinogens, the appropriate values should be substituted into the equations to calculate $RBTC_{IA-nc}$ values for the residential exposure scenario.

B.2.2 Development of Risk-Based Target Concentrations for Sub-Slab Vapor

RBTCs for indoor air can be converted into equivalent RBTCs for sub-slab vapor using the following equation:

$$RBTC_{SS} = \frac{RBTC_{IA}}{\alpha_{SS}}$$

where:

$RBTC_{IA}$	Risk-Based Target Concentration for Indoor Air (ug/m^3)
$RBTC_{SS}$	Risk-Based Target Concentration for Sub-Slab Vapor (ug/m^3)
α_{SS}	Sub-Slab Attenuation Factor (unitless)

As recommended in the DTSC Vapor Intrusion Guidance (DTSC, 2004), a sub-slab attenuation factor of 0.01 (Dawson, 2004) is used to convert RBTCs for indoor air into equivalent RBTCs for sub-slab vapor.

Table B-4 presents carcinogenic and non-carcinogenic RBTCs for sub-slab vapor for the residential exposure scenario.

The minimum RBTCs for sub-slab vapor for chemicals of concern and the corresponding risk driving scenario are included in the summary Table 1 in the main document.

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U.S. EPA, 2004. *User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings (Revised)*, Office of Emergency and Remedial Response, February 2004.

LIST OF TABLES

Table B-1
Non-Carcinogenic Toxicity Factors for Chemicals of Concern
Building 937
Presidio of San Francisco, San Francisco, California

Compound	Inhalation Reference Dose ("RfDi") (a) (mg/kg-day)	Non-Carcinogenic Effects	Source (b)
Benzene	0.017	Hematological abnormalities; nervous system	OEHHA
Chloroform	0.086	Fatty cyst formation in liver	OEHHA
Tetrachloroethene	0.01	Hepatotoxicity; weight gain; kidney damage	OEHHA
Toluene	0.086	Liver and kidney weight changes; nervous and respiratory system	OEHHA
1,1,1-Trichloroethane	0.29	Nervous system and liver effects	OEHHA
Trichloroethene	0.17	Nervous system; eyes	OEHHA
1,2,4-Trimethylbenzene	0.0017	--	PRGs
1,3,5-Trimethylbenzene	0.0017	--	PRGs
Xylenes	0.20	Hyperactivity/decreased body weight; nervous and respiratory system	OEHHA

Notes

(a) Chronic reference exposure levels ("RELs") are converted to inhalation Reference Doses ("RfDs") using the equation:

RfDi (mg/kg-day) = REL ($\mu g/m^3$) x (20 m^3/day) / (70 kg) x (0.001 mg/μg)

(b) Reference doses ("RfDs") were obtained from the following sources, in order of preference:

1. California EPA Office of Environmental Health Hazard Assessment ("OEHHA") table: *All Chronic Reference Exposure Levels Adopted by OEHHA as of February 2005* (http://www.oehha.ca.gov/air/chronic_rels/AllChrels.html).
2. U.S. Environmental Protection Agency Integrated Risk Information System ("IRIS"), 2006
3. U.S. EPA 1997 Health Effects Assessment Summary Tables ("HEAST")
4. U.S. EPA National Center for Environmental Assessment Risk Assessment Issue Papers ("NCEA")
5. U.S. EPA Region IX PRG Tables (October 2004) ("PRGs")

Abbreviations

"--" = no available data

mg/kg-day = milligrams per kilograms per day

Table B-2
Carcinogenic Toxicity Information for Chemicals of Concern
Building 937
Presidio of San Francisco, San Francisco, California

Compound	Weight of Evidence Classification (a)	Inhalation Carcinogenic Slope Factor ("CSFi") $(mg/kg\text{-}d)^{-1}$	Source (b)
Benzene	A	0.1	OEHHA
Chloroform	B2	0.019	OEHHA
Tetrachloroethene	--	0.021	OEHHA
Toluene	--	--	--
1,1,1-Trichloroethane	--	--	--
Trichloroethene	--	0.007	OEHHA
1,2,4-Trimethylbenzene	--	--	--
1,3,4-Trimethylbenzene	--	--	--
Xylenes	--	--	--

Notes
(a) U.S. EPA weight-of-evidence classification is as follows:
A = Human Carcinogen
B1 or B2 = Probable Human Carcinogen; B1 indicates that limited human data are available; B2 indicates that there is sufficient evidence in animals and inadequate or no evidence in humans.
C = Possible Human Carcinogen
D = Not Classifiable as to Human Carcinogenicity
E = Evidence of Non-Carcinogenicity for Humans
Weight-of-evidence information obtained from the U.S. Environmental Protection Agency Integrated Risk Information System database ("IRIS"); the July 1997 U.S. EPA Health Effects Assessment Summary Tables ("HEAST"); or the U.S. EPA National Center for Environmental Assessment Risk Assessment Issue Papers ("NCEA"); in order of precedence.
(b) Slope factors were obtained from the following sources, in order of preference:
1. California Environmental Protection Agency, Office of Environmental Health Hazard Assessment ("OEHHA"), *OEHHA Cancer Potency Factors* table, updated 10 August 2005 (http://www.oehha.ca.gov/risk/pdf/cancerpotalpha81005.pdf)
2. U.S. EPA Integrated Risk Information System database (IRIS), 2006
3. U.S. EPA 1997 Health Effects Assessment Summary Tables ("HEAST")
4. U.S. EPA National Center for Environmental Assessment Risk Assessment Issue Papers ("NCEA")
5. U.S. EPA Region IX PRG Tables (October 2004) ("PRGs")

Abbreviations
"--" = no available data or not applicable
mg/kg-day = milligrams per kilograms per day

Table B-3
Exposure Assumptions
Building 937
Presidio of San Francisco, San Francisco, California

Parameter	Variable	Value	Units	Reference (a)
Air Inhalation Rate	**IRa**			
Adult - Residential		20	m^3/day	DTSC, 2005
Child - Residential		10	m^3/day	DTSC, 2005
Adult - Commercial/Industrial		14	m^3/day	U.S. EPA, 1997 (b); DTSC, 2005
Averaging Time	**AT**			
Non-Carcinogens				
Residential (child)		2,190	days	U.S. EPA, 1991; DTSC, 1996; DTSC, 2005
Commercial/Industrial		9,125	days	U.S. EPA, 1991; DTSC, 1996; DTSC, 2005
Carcinogens				
Residential/Commercial/Industrial (75 years)		27,375	days	U.S. EPA, 1997
Body Weight	**BW**			
Adult		70	kg	U.S. EPA, 1991; DTSC, 1996; DTSC, 2005
Child		15	kg	U.S. EPA, 1991; DTSC, 1996; DTSC, 2005
Exposure Duration	**ED**			
Residential				
Carcinogenic (child)		6	years	U.S. EPA, 1991; DTSC, 1996; DTSC, 2005
Carcinogenic (adult)		24	years	U.S. EPA, 1991; DTSC, 1996; DTSC, 2005
Non-carcinogenic (child)		6	years	U.S. EPA, 1991; DTSC, 1996; DTSC, 2005
Commercial/Industrial				
Carcinogenic and Non-Carcinogenic		25	years	U.S. EPA, 1991; DTSC, 1996; DTSC, 2005
Exposure Frequency	**EF**			
Residential--Child and Adult		350	days/year	U.S. EPA, 1991; DTSC, 1996; DTSC, 2005
Commercial/Industrial		250	days/year	U.S. EPA, 1991; DTSC, 1996; DTSC, 2005

Notes
(a) References for exposure parameter values are as follows:

- U.S. EPA. 25 March 1991. *Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors.* Interim Final. OSWER Directive 9285.6-03.
- U.S. EPA. August 1997. *Exposure Factors Handbook Volume I General Factors: Principles and Applications.* Office of Research and Development. EPA 600/P-95/002F.
- DTSC. August 1996. *Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities* .
- DTSC. October 2005. *Human Health Risk Assessment Note 1,* Human and Ecological Risk Division, 27 October 2005.

(b) Commercial inhalation rate assumes a "moderate industrial job" with a daily work inhalation rate calculated based on approximately 2 hours of light activity, 4 hours of moderate activity, and 2 hours of heavy activity. References: U.S. EPA 1997 and personal communication with Dr. Kimiko Klein, DTSC.

Table B-4
Risk-Based Target Concentrations - Residential Land Use: Child and Adult
Indoor Air and Sub-Slab Vapor
Building 937
Presidio of San Francisco, San Francisco, California

Compound	Values Based on Non-Cancer Hazard at HQ = 1.0 (child)		Values Based on 10^{-6} Incremental Cancer Risk (child+adult)	
	RBTC for Indoor Air (a) $RBTC_{IA-nc}$ ($\mu g/m^3$)	RBTC for Sub-Slab Vapor (b) $RBTC_{SS-nc}$ ($\mu g/m^3$)	RBTC for Indoor Air (a) $RBTC_{IA-c}$ ($\mu g/m^3$)	RBTC for Sub-Slab Vapor (b) $RBTC_{SS-c}$ ($\mu g/m^3$)
Benzene	30	3,000	0.07	7
Chloroform	130	13,000	0.38	40
Tetrachloroethene	20	2,000	0.34	30
Toluene	130	13,000	--	--
1,1,1-Trichloroethane	450	45,000	--	--
Trichloroethene	270	27,000	1.0	100
1,2,4-Trimethylbenzene	3	300	--	--
1,3,5-Trimethylbenzene	3	300	--	--
Xylenes	300	30,000	--	--

Notes

(a) Risk-based target concentrations ("RBTCs") for indoor air are calculated using equations presented in the text of Appendix B of the *Building 937 Remedial Consturction Work Plan.*

(b) The RBTC for sub-slab vapor equals the RBTC for indoor air divided by the sub-slab attenuation factor (0.01).

Abbreviations

"--" = indicates an RBTC is not calculated because the compound does not have a cancer slope factor
COC = chemical of concern
HQ = Hazard Quotient
RBTC = Risk-Based Target Concentration
$RBTC_{IA-nc}$ = RBTC for indoor air for non-carcinogenic COCs
$RBTC_{IA-c}$ = RBTC for indoor air for carcinogenic COCs
$RBTC_{SS-nc}$ = RBTC for sub-slab vapor for non-carcinogenic COCs
$RBTC_{SS-c}$ = RBTC for sub-slab vapor for carcinogenic COCs
$\mu g/m^3$ = micrograms per cubic meter

APPENDIX C

SOIL REMOVAL AND OPTIONAL SUBSLAB VENTILATION DESIGN PARAMETERS

APPENDIX C

SOIL REMOVAL AND OPTIONAL SUBSLAB VENTILATION DESIGN PARAMETERS

Building 937, Presidio of San Francisco, California

Assumptions:

- Building 937 is approximately 17,600 sf, with an approximately 6-inch thick concrete slab.
- The volatile organic chemicals (“VOCs”) tetrachloroethylene (“PCE”) and trichloroethene (“TCE”) have been detected in the subslab vapor above risk-based target concentrations (“RBTCs”) that could lead to indoor air concentrations above acceptable human health goals.
- A source of these VOCs has not been found in soil, groundwater, or soil gas beneath the building. The current conceptual model assumes VOCs are present in the 1 to 3 foot permeable sand layer beneath the slab, but were retarded from further migration into the lower soil or groundwater. VOCs could be concentrated at the permeable sand/low-permeability soil interface.
- Targeted subslab sand removal will be conducted to physically remove the sand which appears to be the media in which the subslab vapors were detected. If staining or other visual indications of impact are observed or chemical concentrations exceed cleanup levels in soil confirmation samples, then additional soil will be removed during the remedial action.
- Piping for a passive subslab ventilation (“SSV”) system may be installed while the slab is removed, but the system will be capped.
- If indoor air sampling data after soil removal indicate RBTCs are exceeded, the subslab ventilation system could be operated. Ventilation of the subslab layer would further mitigate vapor intrusion into the building. If necessary, the SSV system could be converted into an active subslab depressurization (“SSD”) system.
- A Bay Area Air Quality Management District (“BAAQMD”) notification is anticipated to be required if the SSV system is activated, but no air permit or monitoring will likely be required. If the SSV system were converted to active SSD, a BAAQMD permit and associated monitoring would be required. Vapor phase granular activated carbon treatment of the extracted vapor discharge would only be implemented if required by the SSD BAAQMD air permit. Based on available data, vapor treatment is not anticipated.

Design Parameters:

- The existing slab will be removed to allow access to the subsurface and structural modifications.
- Depth of sand removal will be coordinated with areas of highest PCE concentration detected in subslab vapor. The top few inches of the underlying silt will also be examined for staining and may be removed.

- No subslab sand/baserock is anticipated to be removed in the area of the former Army excavation, as no VOCs were detected in samples from that material.
- Soil samples will be collected from the bottom of the excavation on approximately 40 foot centers (assume 10 samples). Sidewall samples will also be collected at approximately 40 foot intervals.
- A subgrade piping network for passive SSV or active SSD may be installed after the subgrade is backfilled and prior to replacement of the slab. A permeable layer of crushed rock would then be required in the top 3 to 6 inches below the slab.
- The piping for the SSV system would be completely installed, and would have valves or caps to close off the subslab influent and effluent flow.
- The piping network may be composed of Liquid Boot's GeoVent system or a combination of solid and slotted PVC or HDPE piping. Piping size is anticipated to be 4 to 6 inches diameter.
- A conceptual subgrade piping layout sketch is presented in Figure 4 of the Building 937 Remedial Construction Work Plan. A piping network to allow fresh influent air into the subslab would be drawn out by a wind-driven turbine-induced vacuum in the SSV piping network. No powered blower is anticipated to be required.
- All piping should be smooth-walled HDPE or PVC. Perforations (e.g., holes in drain pipe) should face downward to allow condensate drainage.
- Other subgrade utilities, footings, and structural supports should be coordinated with the SSV system. The placement, sizing, and components of the SSV system may vary significantly based on the result of factors from other building components. Because crushed rock is expected to extend throughout the area below the slab, no short circuiting is expected from utilities exiting building perimeters.
- Solid discharge piping would lead to a sample port and flow measurement port, and a vent stack to the roof wind turbine. Final discharge should be no closer than 30 feet from any HVAC intake and SSV system intake.
- Subslab vapor and pressure monitoring points would be installed to evaluate subslab conditions and effectiveness of the operating system. Monitoring points would ideally be installed midway between the influent and effluent piping. The monitoring points would consist of copper or steel tubing with the end wrapped in cloth or geotextile to prevent clogging. Each tube would be placed in the subgrade before the slab was poured and routed to a common sampling location. Pressure measurements and subslab vapor samples could be collected from a sample port at the end of the tube. At the sampling station, each tube would be marked to indicate the location below in the subslab. Use of tubing below the slab routed to a common collection point allows the sample collection to be conducted without interrupting tenant operations. The routing of the tubing and sample station should be coordinated with the architect and structural engineer to coordinate with other building features. The sample station cannot be located in the presence of cleaning solutions, such as in a janitor's closet or a restroom.
- No subslab liner is proposed for the SSV system. To the extent that such a liner remains intact, the liner provides an additional means along with the SSV system to limit the potential for vapors to enter the building. The long-term efficacy of a

liner system is unknown, and cannot be monitored, tested, or repaired after the slab is poured.

APPENDIX D

DETAILED COST TABLE

TABLE D-1
PRELIMINARY ESTIMATE OF PROBABLE COSTS
CAPITAL COSTS FOR REMEDIAL ACTION
SUBSLAB SAND REMOVAL

Building 937, Presidio of San Francisco
San Francisco, California

Task Description (a)	ESTIMATED COSTS (b)				
	Unit	Quantity	Unit Cost	Subtotal	Total (c)
Construction Costs					
• Construction Mobilization/Demobilization	1	10%	$193,166	$19,317	
• Sawcut and Demolish 6 Inch Concrete Slab (d)	sf	17,600	$2.50	$44,000	
• Excavate, Stockpile, and Load Subslab Sand (e)	cy	840	$10	$8,400	
• Sand Stockpile Sample Coordination and Collection	ea	3	$90	$270	
• Sand Stockpile Sample Analysis (EPA Method 8260B) (f)	ea	3	$100	$300	
• Surveying of Soil Confirmation Sample Locations (g)	day	2	$915	$1,830	
• Soil Confirmation Sample Coordination and Collection	ea	10	$35	$350	
• Soil Confirmation Sample Analysis (h)	ea	10	$200	$2,000	
• Input Analytical Results to Trust Database	ea	13	$18	$234	
• Stockpile and Confirmation Sample Data Management and Validation	ea	13	$34	$442	
• Transport and Dispose of Sand Offsite (assume non-hazardous) (i)	tons	1,428	$35	$49,980	
• Profile Sample of Backfill for Subgrade Material Replacement	ea	2	$1,800	$3,600	
• Replace Subgrade Material	cy	840	$24	$20,160	
• Replace 6 Inch Concrete Slab (d)	sf	17,600	$3.50	$61,600	
					$212,483
Engineering Costs					
• Implementation Work Plan	ls	1	$20,000	$20,000	
• Appendices to Implementation Work Plan	ea	2	$1,000	$2,000	
• Planning and Remedial Design	ls	1	$25,000	$25,000	
• Construction Observation					
Resident Engineer/Site Supervisor	week	1	$5,950	$5,950	
Field Administrative Support	week	1	$2,380	$2,380	
Field Vehicles and Equipment	week	1	$1,547	$1,547	
Geotechnical and Compaction Testing	week	0.4	$3,868	$1,547	
Air Monitoring	week	1	$1,190	$1,190	
• Construction Completion Report (j)	ls	1	$50,000	$50,000	
• Engineering Project Management	ls	10%	$109,614	$10,961	
					$120,576
Indoor Air Monitoring (Post-Construction) (k)					
• Mobilization and Equipment Rental (2 Events)	ea	2	$250	$500	
• Sample Collection	ea	12	$1,750	$21,000	
• Analyze indoor air samples (EPA Method TO-14)	ea	12	$113	$1,356	
• Data Validation	ea	12	$34	$408	
• Input Analytical Results to Trust Database	ea	12	$18	$216	
					$23,480
Subtotal Estimated Costs (w/ contractor overhead and profit):					*$356,500*
Subtotal Estimated Costs Updated to 2008 Dollars (l):					*$374,000*
Legal and Administrative Costs (assumed to be 5 percent of construction costs):					*$18,700*
Subtotal Estimated Costs (w/ legal and administrative costs):					*$393,000*
Contingencies (assumed to be 20 percent of subtotal estimated costs w/ legal and administrative costs):					*$78,600*
Total Preliminary Estimated Capital Costs of Remedial Alternative:					***$470,000***

TABLE D-1
PRELIMINARY ESTIMATE OF PROBABLE COSTS
CAPITAL COSTS FOR REMEDIAL ACTION
SUBSLAB SAND REMOVAL

Building 937, Presidio of San Francisco
San Francisco, California

Notes:

(a) This is a conceptual-level cost estimate. No annual costs are anticipated.
(b) Costs are based on Trust Unit Costs Master Reference Table, July 2006 ("Trust Table"), unless otherwise noted.
(c) Totals may not sum exactly due to rounding.
(d) Costs for sawcutting and demolishing of the slab as well as slab replacement were provided by TKG International (personal communication, 11/8/2007).
(e) In place sand volume of 600 cy multiplied by 1.4 to determine excavation volume (per Trust Table).
(f) Samples of stockpiled sand will be analyzed by EPA Method 8260B for VOCs on a 10-day turn-around time prior to disposal.
(g) Surveying costs assume 1 day of field work and 1 day of office work to generate a map of survey locations.
(h) Confirmation soil samples will be analyzed for VOCs by EPA Method 8260B. Costs assume analysis on a 1-day turn-around time.
(i) Sand volume multiplied by 1.7 tons/cy to convert to tons (per Trust Table).
(j) Closure report cost is assumed to take place after the second round of indoor air sampling.
(k) Estimated cost for two rounds of indoor air sampling assumes analysis of 5 samples plus a duplicate for each round by EPA Method TO-14 on a 10-day turn-around time.
(l) Costs adjusted for inflation by applying the Engineering News Record ("ENR") factor of 1.0478.

APPENDIX E

FIELD METHODS AND PROCEDURES FOR SOIL SAMPLING, AND INDOOR AND AMBIENT AIR SAMPLING

APPENDIX E

FIELD METHODS AND PROCEDURES FOR SOIL SAMPLING, AND INDOOR AND AMBIENT AIR SAMPLING

Building 937, Presidio of San Francisco, California

This appendix serves as a sampling plan for collection of soil confirmation samples during soil removal activities and collection of indoor and ambient air samples.

E-1 Sample Naming Conventions

In accordance with the Presidio Quality Assurance Project Plan ("QAPP"), sample location identification codes are based on "937" for Building 937; "EX" for excavation sample, "VS" for vapor sample, "IA" for indoor air, "AA" for ambient air; and sequential numbering starting at 200 for Building 937 (to avoid confusion with investigation sampling numbered in the 100s). The media sampled will be marked on the chain of custody form and input into the media field in the Trust database when the data are uploaded. In keeping with the QAPP, a soil sample from 2 feet below ground surface will be designated as 937EX201[2].

E-2 Excavation Confirmation Soil Sampling

If staining is observed during slab removal or sand excavation activities, the stained soil will be removed and the soil beneath the stained level will be screened with an organic vapor meter ("OVM") for volatile organic compounds ("VOCs"). If VOCs are detected above background levels measured by the OVM, an additional layer of soil (depth to be determined in the field) should be removed prior to sample collection. Soil samples will be collected from the excavation bottom on approximately 40 foot centers within the excavation area (at least one sample per excavation bottom). Sidewall samples will also be collected approximately every 40 linear feet (see Figure 4 of the main text) or at least one sample per sidewall face. Soil sampling for VOCs will be conducted with an EnCore sampler in accordance with Standard Operating Procedure ("SOP") 001, SOP 014, and SOP 015. Samples will be analyzed for VOCs by EPA Method 8260. Sample results will be compared to soil risk-based target concentrations ("RBTCs"), and represented areas will be over-excavated if sample results exceed RBTCs.

E-3 Stockpile Soil Sampling

Stockpile samples will be collected in accordance SOP 12. For metals and non-volatile analyses, a minimum of four samples will be collected in jars from each stockpile to be sampled and composited in the laboratory. For VOC analysis, a minimum of four EnCore samplers will be filled and transmitted to the laboratory to composite during solvent addition. Stockpile samples will be analyzed for VOCs by EPA Method 8260 and any other analyses required by the disposal facility.

E-4 Air Sampling

Two rounds of indoor and ambient air samples will be collected prior to recommendation for closure, at least four months apart to address seasonal variations (i.e., winter and summer). Air samples will be collected in six-liter SUMMA canisters. When the sampling canisters are requested from the laboratory, the sampling duration will be specified so that the laboratory can pre-set the flow controller rates. By providing the appropriate sample duration to the laboratory, the laboratory can simulate the proper pressure and set flow controllers accordingly. A fixed-flow controller is set to collect 5 liters (L) of sample over the time interval so that a net negative pressure is maintained in the canister. The flow rate for a 6-L canister collecting an 8-hour composite sample would be approximately 13.35 milliliters per minute.

Per Department of Toxic Substances Control ("DTSC") guidance, a trip blank will be submitted for each day of air sampling. An extra evacuated canister will be sent from the laboratory with the canisters in which the air samples will be collected. The trip blank canister will be placed in the building when the other air samples are being collected, but it will remain under vacuum and will be filled by the laboratory after the return of the now full sample canisters. Although the DTSC guidance requires a trip blank, if the trip blank canister fails (i.e., if compounds are detected in the trip blank), it will indicate that the vacuum was fully not maintained on that particular canister; it will not necessarily indicate that any of the other sample canisters have failed.

E-4.1 Indoor Air Sampling

Since the Trust intends to lease Building 937 to commercial interests, the indoor air samples will be collected over an eight-hour period. Sample locations will be selected based on the building configuration, and as discussed with DTSC representatives. Building 937's ventilation and heating systems will be upgraded; in accordance with the DTSC guidance, the building will be sampled with windows closed and the heating and ventilation system operating in their normal mode.

The Trust plans to collect up to three indoor air samples plus a duplicate, for a total of four indoor air samples. A duplicate indoor air sample will collected at the sample location nearest the area of expected highest VOC concentration.

E-4.2 Ambient Air Sampling

Ambient air samples will be collected in order to provide verification that the laboratory is able to detect low ambient levels of COCs and to help determine how sources outside of Building 937 may impact indoor air quality. Samples will likely be collected near the roll up door of the building as well as at the existing concrete wash rack located north of the building (where samples were previously collected). The samplers will be secured or monitored to prevent disturbance over the course of the sampling period.

Per DTSC guidance to reflect the source air for the building, collection of the two ambient air samples will begin one to two hours before initiation of indoor air sampling. The ambient air samples will also be collected over an eight-hour period.

E-4.3 Air Sample Analyses

Indoor and ambient air samples will be analyzed by a state certified laboratory using EPA Method TO-14. Selected ion monitoring ("SIM") will used if needed for detection limits to meet applicable RBTCs. Indoor and ambient air samples will only be analyzed for compounds detected in the subslab vapor. If the air sample results are greater than RBTCs, then the Trust may collect additional samples, evaluate the potential sources of the chemicals, uncap the optional subslab ventilation ("SSV") system, or convert the passive SSV system to an active subslab depressurization ("SSD") system. Any such change in the remedial action approach at Building 937 will be discussed with DTSC and NPS.

E-5 Disposal of Investigation-Derived Wastes

Wastes generated during the sampling at Building 937 will include equipment decontamination materials as well as gloves and other personal protective equipment. Any wastes generated during the sampling event will only be exposed to limited vapor concentrations which are not likely to contain chemicals of concern. Therefore, no hazardous waste residuals are expected from the sampling.

APPENDIX F

PERIMETER AIR MONITORING PLAN

APPENDIX F

PERIMETER AIR MONITORING PLAN

Building 937, Presidio of San Francisco, California

F-1 Introduction

Erler & Kalinowski, Inc. ("EKI") has prepared this Perimeter Air Monitoring Plan ("AMP") on behalf of the Presidio Trust ("Trust") as part of the Building 937 Remedial Construction Work Plan ("RCWP"). This AMP will be implemented during removal activities at Building 937 in the northwestern portion of the Presidio. The volatile organic compounds ("VOCs") tetrachloroethene ("PCE") and trichloroethene ("TCE") have been detected in subslab vapor above risk-based target concentrations ("RBTCs").[1]

The perimeter air monitoring activities described in this appendix will be implemented during remedial activities by the remediation contractor, consultant, or industrial hygienist. The air monitoring activities were developed to protect the adjacent workers and recreational users from exposure to VOCs and to evaluate adequacy of dust and vapor control methods being applied by the contractor implementing the remedial action. The remedial action is described in the main text of this RCWP. The location of Building 937 is shown on Figure 1 of the main text of this RCWP.

F-2 Potential Exposure to Chemicals of Concern

It is anticipated that remedial construction activities in which potential emissions of VOCs could occur will be performed for up to five days of active work. This assumption does not include the project setup time, the time to backfill with clean, imported fill, nor the time to install new utilities, foundations, footings, and floor slab. For risk calculation purposes, it is conservatively assumed that remedial construction will occur up to 8 hours a day, 5 days a week for one week.

Real-time air monitoring for total VOCs will be conducted throughout the work shift using an organic vapor meter ("OVM"). The detection limit of the OVM is 1 part per million by volume ("ppmv").

In addition, EKI anticipates that diesel powered equipment will be operated within the building, and the contractor will be ventilating the building to protect the workers within the space. The contractor will not be permitted to discharge concentrated diesel fumes at

[1] For comparison purposes, the highest detected concentration of PCE from the subslab vapor from sample location 937VS104 of 39,900 $\mu g/m^3$ is equivalent to 5.8 ppmv. Then next highest concentration at location 937VS107 of 7,470 $\mu g/m^3$ is equivalent to approximately 1.0 ppmv. Note, however, that these are subslab concentrations, and there is significant potential for dilution prior to these chemicals reaching the Site perimeter.

the worksite perimeter where offsite populations could be impacted. While dust may be generated by the concrete demolition activities, VOCs are not anticipated to be associated with such dust. The contractor will employ standard construction dust control techniques, such as misting with water.

F-3 Selection of Action Levels

As noted above, the objectives of the perimeter air monitoring during remedial actions at Building 937 are to protect the surrounding workers and recreational users from exposure to VOCs and to evaluate the adequacy of vapor control methods being applied by the remediation contractor.

Because remedial activities in which potential emissions of chemicals of concern ("COCs") are projected to occur over approximately 5 days, any potential incremental chemical exposures associated with this project are short-term. Federal and state workplace standards are not directly applicable to potential off-site exposures to airborne chemicals beyond the Building 937 Area perimeter during remedial construction.

The United States Public Health Service, Agency for Toxic Substances and Disease Registry ("ATSDR") acute minimal risk levels ("MRLs") for PCE and TCE are 0.2 ppmv and 2.0 ppmv, respectively. The acute value is for exposures from 1 to 14 days, which applies to this RCWP.

Although chemical-specific Action Levels for PCE and TCE are available from ATSDR, because the construction project will be of such short duration, real time monitoring of total VOCs will be a more useful tool in identifying and controlling VOC emissions than collecting samples for offsite laboratory analysis. While the OVM's 1 ppmv detection limit for total VOCs is not specific for PCE's acute MRL, the OVM provides real time indication of potential emissions. Furthermore, given that all but one of the sampled subslab PCE concentrations were less than 1 ppmv, there is a very high likelihood of adequate dilution before the vapors reach the Site perimeter.

F-4 Perimeter Air Sampling Protocols

Real-time monitoring for total VOCs will be performed using a calibrated OVM. The OVM will be calibrated per the manufacturer's specifications with isobutylene and equipped with a 10.6 electronvolt sensor to allow for the detection of total VOCs, including the target compounds PCE and TCE. The OVM, which will be a model MiniRAE 2000 or equivalent, will be carried by the field staff along the perimeter of the Site (outside Building 937) approximately hourly to collect real-time airborne total VOC concentrations. Total VOC concentrations will be recorded on field log sheets. When soil excavation and loading activities are performed in close proximity to the Site perimeter, the OVM will be utilized along the Site perimeter at the nearest safe distance from the active work area.

The OVM has a detection limit of 1 ppmv and does not provide airborne concentrations for individual VOCs. If field representatives obtain sustained OVM readings (i.e., more than 5 minutes) greater than 1 ppmv above background near the active working area, the concentration at the Site perimeter will be checked. If sustained OVM readings greater than 1 ppmv above background are observed mid way between the perimeter and the working area, work will be halted temporarily and VOC control techniques (e.g., spraying and misting with water, covering exposed soil, with plastic sheeting) will be increased.

F-5 Reference

ATSDR, 2004. Agency for Toxic Substances and Disease Registry, Division of Toxicology, December 2004, *Minimal Risk Levels (MRLs) for Hazardous Substances*.